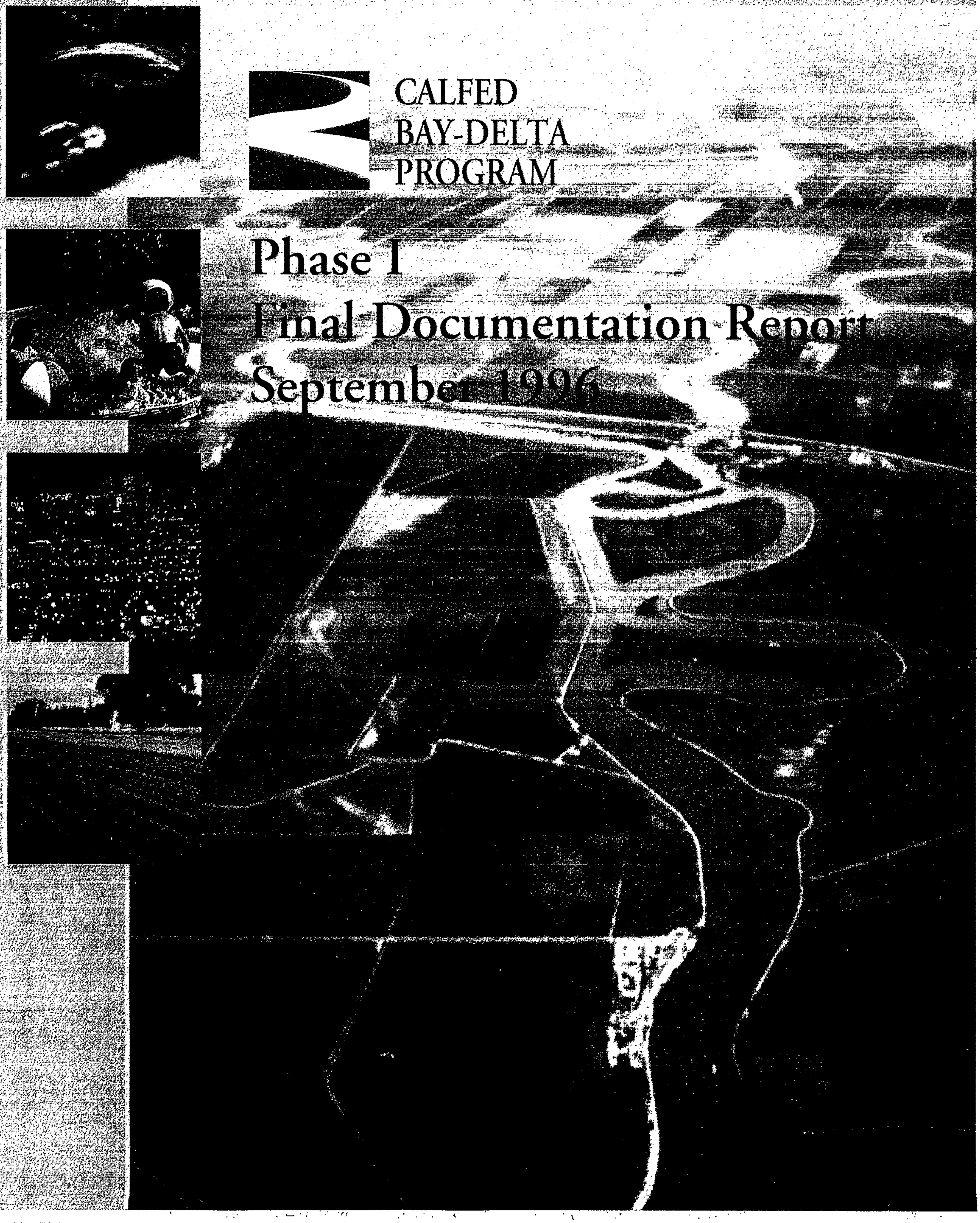
CALFED
BAY-DELTA
PROGRAM

Phase I
Final Documentation Report
September 1996



Phase I Final Documentation Report

CALFED
BAY-DELTA
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The CALFED Bay-Delta Program is a joint effort among state and federal agencies with management and regulatory responsibilities in the Bay-Delta system. The Program involves significant public and stakeholder involvement, and seeks resolution of Bay-Delta problems through collaboration.

CONTENTS

Perspective

This report provides documentation for Phase I of the CALFED Bay-Delta Program, a three-phase effort to develop a long-term solution to problems affecting the San Francisco Bay/Sacramento-San Joaquin Delta estuary (the Bay-Delta) in Northern California.

Four general categories of critical problems facing the Bay-Delta are defined—ecosystem quality, water quality, water supply reliability, and system vulnerability—along with three Phase II Alternative solutions to these problems. To practicably achieve the Program purpose to restore ecological health and improve water management for beneficial uses of the Bay-Delta system, the CALFED alternatives will concurrently address problems within these four critical resource categories. **Accordingly, a solution to problems in one resource category cannot be pursued without addressing problems in the other resource categories.**

These alternatives represent combinations of actions that address each of the problems in the Bay-Delta's four critical areas. None are final products; all are subject to further public input, additional refinement, and technical evaluation in Phase II of the Program.

Moreover, these alternatives represent concepts, not project-level proposals. They focus on identifying a range of balanced actions that might be undertaken to address Bay-Delta problems—not when, where, and how specific actions should be taken to address these problems. Both the problems and draft solutions have been identified in the Program's first phase. Phase II investigations will lead to identification of one preferred alternative. In Phase III, site specific environmental documentation will be prepared and the preferred alternative will be implemented. Phase III will begin in mid to late 1998 and continue in a staged fashion over several years.

The three alternatives described in this document will continue to be refined in Phase II through technical evaluation and input from the public, the Bay-Delta Advisory Council (BDAC), and CALFED agencies. The three Phase II Alternatives differ primarily in their configurations of Delta conveyance. Each alternative includes the same four common programs related to water use efficiency, water quality, system integrity, and ecosystem restoration. Each alternative could also include some combination of storage to support the common programs and the Delta conveyance. The Program welcomes questions regarding these Phase II Alternatives. Program staff may be reached by telephone at 916/657-2666.

PHASE II ALTERNATIVES

Alternative 1
- More efficient use of the existing system of conveyance

Alternative 2
- Modified Through Delta conveyance

Alternative 3
- Dual conveyance utilizing both Through Delta and isolated facility

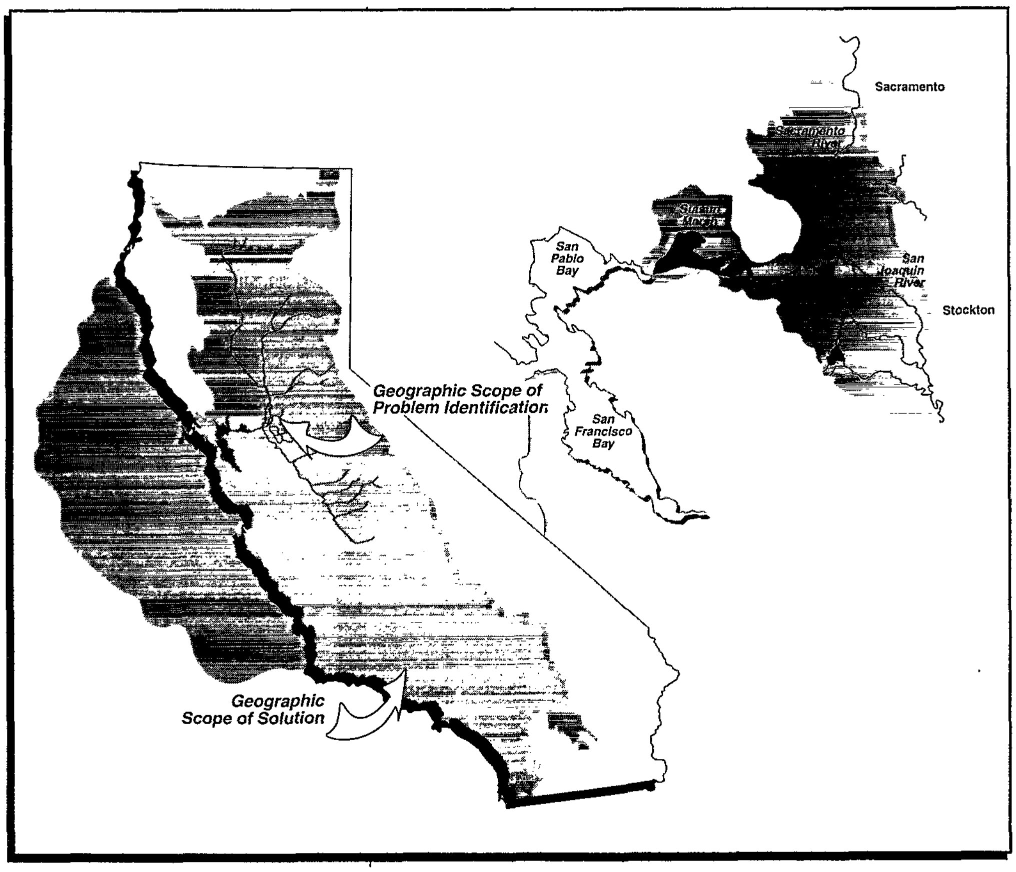
Each alternative includes:
- Storage component (to be detailed in Phase II)
- Common programs for water use efficiency, water quality, levee system integrity, and ecosystem restoration

Program Overview

The Bay-Delta is the largest estuary on the West Coast, a beautiful, lush, and varied ecosystem including a maze of tributaries, sloughs, and islands encompassing approximately 700 square miles. Lying at the confluence of California's two largest rivers, the Sacramento and the San Joaquin, it is a haven for plants and wildlife, including 70,000 acres of wetlands and supporting 120 fish and wildlife species.

In addition to its ecological importance, the Bay-Delta is critical to California's economy, supplying drinking water for two-thirds of Californians and irrigation water for 200 crops, including 45 percent of the nation's fruits and vegetables.

Given this importance, the area has for decades been the focus of competing interests—economic and ecological, urban and agricultural. And, it has suffered from this. Numerous efforts have been made to address Bay-Delta problems. But the issues are complex and interrelated, and many continue unresolved.



PROGRAM ORGANIZATION

The CALFED Bay-Delta Program has two fundamental organizational characteristics that distinguish it from other government programs.

First, it is a cooperative, interagency effort involving a number of state and federal agencies with management and regulatory responsibilities in the Bay-Delta. A Program Coordination Team (PCT) made up of individuals from each participating agency provides liaison between the Bay-Delta Program and policy and technical experts within these agencies. The PCT provides direction in Program design and activities, and acts to ensure that Program decisions and direction are consistent with the goals and objectives of the participating agencies.

Second, it is a collaborative effort with Bay-Delta "stakeholders"—urban and agricultural water users, fishing interests, environmental organizations, businesses, and others—who contribute to Program design and to the problem-solving/decision-making process. Public participation and input have been essential throughout the process to date, and have come principally through the BDAC, public participation in workshops and meetings and hundreds of comment letters.

ORGANIZATIONAL HISTORY AND STRUCTURE OF THE CALFED BAY-DELTA

The CALFED Bay-Delta Program was established in May 1995 and is one element of CALFED, a consortium of five state agencies and five federal agencies with management and regulatory responsibilities in the Bay-Delta.

At the state level, these agencies include the California Resources Agency, Department of Water Resources, Department of Fish and Game, California Environmental Protection Agency, and State Water Resources Control Board. At the federal level, participating agencies include the U.S. Department of Interior, Bureau of Reclamation, Fish and Wildlife Service, Environmental Protection Agency, and National Marine Fisheries Service. The U.S. Army Corps of Engineers also participates as a cooperating agency.

CALFED provides policy direction to the Program. It was formed as part of a Framework Agreement signed in June 1994 by California Governor Pete Wilson and by Bruce Babbitt, Secretary of the U.S. Department of the Interior. As part of this Framework Agreement, the state and federal governments pledged to work together to formulate water quality standards to protect the Bay-Delta, coordinate State Water Project (SWP) and Central Valley Project (CVP) operations in the Bay-Delta, and develop a long-term Bay-Delta solution.

In December 1994, an agreement—the Bay-Delta Accord—was signed by state and federal regulatory agencies, with the cooperation of diverse interest groups, to address these issues. This accord set out integrated, water quality standards, and created a state/federal coordination group to better integrate the SWP and CVP. The Bay-Delta Program is charged with responsibility for the third issue: development of a long-term Bay-Delta solution.

Impetus to forge this long-term solution came at the state level in California in December 1992 with formation of the Water Policy Council and the Bay Delta Oversight Council, an advisory group to the Water Council. The following year, in September 1993, the Federal Ecosystem Directorate was created at the federal level to coordinate federal resource protection and management decisions for the Bay-Delta.

The BDAC is chartered under the Federal Advisory Committee Act and includes representatives of stakeholder groups appointed by the administration of California Governor Pete Wilson and by Bruce Babbitt, Secretary of the U.S. Department of the Interior.

The Program is managed by CALFED staff, with assistance from consulting organizations and is structured in three phases. Phase I, development of a range of solution alternatives to Bay-Delta system problems, began in May 1995 and is the subject of this report.

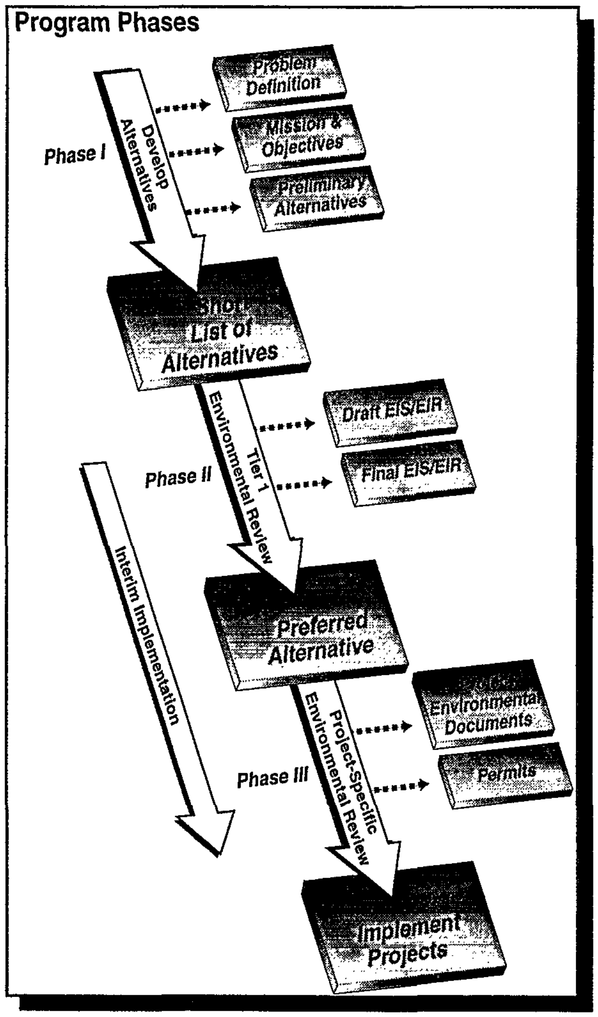
CALFED

Resources Agency of California	U.S. Department of Interior
Department of Water Resources	Bureau of Reclamation
Department of Fish and Game	Fish and Wildlife Service
California Environmental Protection Agency	Environmental Protection Agency
State Water Resources Control Board	National Marine Fisheries Service

Phase II is a programmatic environmental review, reconnaissance-level analysis, and pre-feasibility-level planning effort to identify one preferred solution alternative. Programmatic environmental reviews focus on broad policy and resource allocation decisions required to implement a program and are designed to inform decision makers about the interrelated and cumulative consequences of the alternatives. Reconnaissance-level analysis and pre-feasibility-level planning focus on further refinement of alternatives. Foundational work for Phase II began in January 1996. However, the majority of this effort began in June 1996 and will conclude in mid to late 1998.

Phase III will include site-specific environmental review of individual components of the preferred alternative selected at the conclusion of Phase II. Implementation of elements of this alternative could begin by mid 1998 and will continue in a staged fashion over several years.

Other efforts are under way outside the CALFED Bay-Delta Program to address some of the problems and solutions being explored by the Program, particularly in upstream areas. Opportunities to aid or draw from these separate efforts have been and will continue to be addressed.



PHASE I OBJECTIVES

Phase I has resulted in a short list of three alternative solutions to Bay-Delta problems that will undergo assessment in Phase II of the Program. The three alternatives presented and discussed in this report will be further refined in Phase II of the Program.

Initial focus in Phase I was to define Bay-Delta problems and Program objectives, and to identify actions that could be taken to resolve these problems and meet these objectives. In addition, strategies were developed to identify, assemble, and refine the alternatives.

A six-step process was used to accomplish these goals, and Program workshops were convened to gather public comment at each step. Workshop 1 was held in August 1995 and focused on problem identification; workshop 2 was held in September 1995 and focused on defining Program objectives; workshop 3 was held in October 1995 to identify actions to resolve problems and meet objectives; workshop 4 focused on developing solution strategies and was held in December 1995; workshop 5 was held in February 1996 to assess an initial draft set of 20 alternatives: workshop 6 was held in April 1996 and focused on refining a draft set of 10 alternatives; workshop 7 was held in June 1996 to present draft versions of the three Phase II Alternatives described in this report.

Primary Program objectives are to provide good water quality for all beneficial uses; to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species; to reduce the mismatch between Bay-Delta water supplies and current and projected

CALFED BAY-DELTA PROGRAM MISSION STATEMENT

The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system.

The mission statement also includes the Program Objectives and a set of six "solution principles"—fundamental guides for evaluating alternative solutions:

- ***Reduce Conflicts in the System*** Solutions will reduce major conflicts among beneficial uses of water.
- ***Be Equitable*** Solutions will focus on solving problems in all problem areas. Improvements for some problems will not be made without corresponding improvements for other problems.
- ***Be Affordable*** Solutions will be implementable and maintainable within the foreseeable resources of the Program and stakeholders.
- ***Be Durable*** Solutions will have political and economic staying power and will sustain the resources they were designed to protect and enhance.
- ***Be Implementable*** Solutions will have broad public acceptance and legal feasibility, and will be timely and relatively simple to implement compared with other alternatives.
- ***Have No Significant Redirected Impacts*** Solutions will not solve problems in the Bay-Delta system by redirecting significant negative impacts, when viewed in their entirety, within the Bay-Delta or to other regions of California.

beneficial uses dependent on the Bay-Delta system; and to reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees. Bay-Delta problems and Program subobjectives are shown in the table on the following page.

The Program's mission statement calls for development of a "long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system". The detail for carrying out the mission is described in the Program's objectives and the solution principles. The objectives are technical, while the solution principles offer broad policy guidance.

BAY-DELTA PROBLEM AREAS & PROGRAM OBJECTIVES

ECOSYSTEM QUALITY

Problems	Objectives
• Important aquatic habitats are inadequate to support production and survival of native and other desirable estuarine and anadromous fish in the Bay-Delta system. Examples of fishes that have experienced declines related to changes in Delta habitat include delta smelt, longfin smelt, Sacramento splittail, chinook salmon, striped bass, and American shad.	• Improve and increase aquatic habitats so they can support the sustainable production and survival of native and other desirable estuarine and anadromous fish in the estuary.
• Important wetland habitats are inadequate to support production and survival of wildlife species in the Bay-Delta system.	• Improve and increase important wetland habitats so they can support the sustainable production and survival of wildlife species.
• Populations of some species of plants and animals dependent on the Delta have declined.	• Increase population health and population size of Delta species to levels that assure sustained survival.

WATER QUALITY

Problems	Objectives
• Water quality is often inadequate or is perceived as inadequate for drinking water needs.	• Provide good water quality in Delta water exported for drinking water needs.
• Delta water quality is often inadequate for agricultural needs.	• Provide good Delta water quality for agricultural use.
• Delta water quality is often inadequate for industrial needs.	• Provide good Delta water quality for industrial use.
• Delta water quality is often inadequate for recreational needs.	• Provide good Delta water quality for recreational use within the Delta.
• Water quality is often inadequate for environmental needs for the Bay-Delta system.	• Provide improved Delta water quality for environmental needs.

WATER SUPPLY RELIABILIITY

Problems	Objectives
• Water supplies of the Bay-Delta system do not meet needs because of conflict among beneficial uses and because of system inadequacies.	• Reduce the conflict between beneficial uses and improve the ability to transport water through the Bay-Delta system.
• Bay-Delta system water supplies are uncertain with respect to short- and long-term needs.	• Reduce the uncertainty of Bay-Delta system water supplies to help meet short- and long-term needs.

BAY-DELTA SYSTEM VULNERABILITY

Problems	Objectives
• Existing agricultural land use, economic activities, and infrastructure in the Delta are at risk from gradual deterioration of delta conveyance and flood control facilities as well as sudden catastrophic inundation of Delta islands.	• Manage the risk to existing land use, associated economic activities, and infrastructure from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands.
• Water supply facilities and operations in the Delta are at risk from increased salinity intrusion which can result from sudden catastrophic inundation of Delta islands.	• Manage the risk to water supply facilities and operations in the Delta from catastrophic inundation of Delta islands.
• Water quality in the Delta is at risk from increased salinity intrusion which can result from sudden catastrophic inundation of Delta islands.	• Manage the risk to water quality in the Delta from catastrophic inundation of Delta islands.
• The existing Delta ecosystem is at risk from gradual deterioration of Delta conveyance and flood control facilities as well as catastrophic inundation of Delta islands.	• Manage the risk to the existing Delta ecosystem from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands.

ACTIONS TO RESOLVE BAY-DELTA PROBLEMS

Forty-nine categories of potential actions to resolve Bay-Delta problems and achieve Program objectives were identified by reviewing existing literature and soliciting input from the agencies, BDAC members, stakeholders, and the general public. Within these categories, hundreds of individual actions were defined.

From among this list, "core actions"were identified—actions that Program participants felt should be included as part of all program alternatives. Core actions, shown on the following page, generally enjoy broad support among stakeholders; provide a benefit to the entire Bay-Delta system; are cost effective; meet one or more Program objective(s); and provide some progress toward a solution but do not represent a satisfactory solution by themselves.

CATEGORIES OF ACTIONS THAT COULD BE TAKEN TO RESOLVE BAY-DELTA PROGRAMS AND MEET PROGRAM OBJECTIVES

- **Restore Bay-Delta System Habitats**
- **Restore Upstream Habitat**
- **Reduce Effects of Diversions**
- **Manage the Enhancement of Anadromous Fish Populations**
- **Reduce Reliance on Delta Exports**
- **Enhance Water Supplies**
- **Increase Supply Predictability**
- **Manage Water Quality**
- **Improve System Reliability**

Note: Forty-nine categories of actions, containing hundreds of individual actions, are included under these headings.

Moreover, core actions do not preclude or conflict with other actions; do not increase conflicts between beneficial users or stakeholders; do not represent a major program activity or major facility structure; and do not create significant adverse, site-specific impacts or redistribute costs.

Core actions were originally prepared as a set of actions that could be included in all alternatives for potential early implementation. Since the structure of the alternatives changed in preparation of the three Phase II Alternatives (see Alternatives Overview and Descriptions section), core actions are no longer viewed as a single set of actions. Rather, these actions are now distributed between the four common programs included in each of the three phase II Alternatives. In this manner, these actions basically serve the same role as when originally formulated but are now viewed as the first stage implementation within each of the four common programs.

Establishing an appropriate geographic scope within which to identify Bay-Delta problems and develop solution alternatives was an important aspect of this action identification process. To address this concern, separate problem and solution scopes were defined.

- *Problem Scope* The Program addresses problems that exist within the legally defined Delta (i.e., Suisun Bay, extending to Carquinez Strait, and Suisun Marsh) or are closely linked to this area. See the map on page 2. Examples would include toxic inflows and outflows, in-migrating fish, and water diversion patterns.

- *Solution Scope* Because the Bay-Delta solution is part of a larger water and biological resource system, a much broader solution scope has been defined—one including at least the Central Valley watershed, the Southern California water system service area, and the portions of the Pacific Ocean out to the Farallone Islands. This is necessary because many problems related to the Bay-Delta are caused by factors outside the Bay-Delta. For example, salmon population problems are linked to the Bay-Delta due to high mortality rates during salmon migrations. While one solution would be to reduce mortality during salmon migration through the Bay-Delta, it might be less expensive or ecologically preferable to promote greater salmon production upstream. An expanded solution scope is also desirable from a planning perspective because more benefits may be generated at lower cost if solutions are not limited to the geographic Bay-Delta.

ACTIONS TO BE INCLUDED IN COMMON PROGRAMS FOR ALL ALTERNATIVES (Originally "Core Actions")

Bay-Delta Habitat Restoration

- Protect and Enhance Existing Shallow-Water Habitat
- Protect and Enhance Existing Riverine Habitat on Channel Islands
- Improve Riverine Habitat Elements at Channel Edges by Modifying Levee Protection Practices
- Protect and Enhance Existing Riparian Habitat
- Improve Riparian Habitat by Modifying Levee Maintenance Practices
- Improve Degraded Riparian Habitats
- Protect and Enhance Existing Wetlands
- Expand Wetland Acquisition Programs
- Protect and Enhance Existing Upland Habitat
- Encourage Wildlife-Friendly Agricultural Practices
- Preserve in-Delta Agricultural Land Uses Providing Habitat
- Improve Regulations Regarding Ballast-Water Releases
- Improve Border Inspection Practices
- Establish a Program for Control of Introduced Species

Upstream Habitat Restoration

- Improve Flows and Temperatures in Upstream Habitats
- Maintain Adequate Spawning Substrates
- Encourage Gravel-Mining Practices That Protect Fish Habitat
- Modify Fish Passage at Upstream Dams or Through Other Barriers
- Modify Natural Barriers To Improve Fish Passage
- Encourage Improved Livestock Management in Riparian Habitats
- Revegetate Degraded Riparian Habitats

Reductions in the Effects of Diversions

- Use Real-Time Monitoring and Adaptive Management
- Install Screens on Unscreened In-Delta Diversions
- Install or Upgrade Screens on Upstream Diversions

Management of Anadromous Fish

- Modify Hatchery Operations to Reduce Effects on Wild Populations
- Improve Data Collection and Analysis Needed To Manage Harvest

Reductions in Export Reliance

- Establish Incentives for Use of Agricultural Water Conservation Practices
- Increase Incentives for Use of Municipal and Industrial Conservation Practices
- Educate Small Agencies about Conservation and Reclamation Feasibility

Water Supply Enhancement

- Establish Incentives for Conjunctive Use
- Ease Institutional Barriers To Encourage Conjunctive Use

Increasing Water Supply Predictability

- Coordinate Statutory and Regulatory Water Transfer Responsibilities
- Improve Planning and Coordination Procedures for Water Transfers
- Improve Operational Procedures to Facilitate Water Transfers
- Establish a Water Transfer Brokering Mechanism or Institution
- Manage Water Resources Data and Information for the Bay-Delta System
- Encourage Long-Term Drought Contingency Planning

Management of Water Quality

- Establish Incentives for Retirement of Lands with Drainage Problems
- Provide Incentives for Pollution Source Control on Agricultural Lands
- Manage Riparian Zones To Protect Water Quality
- Manage Land Uses To Protect Water Quality

Improvements to System Reliability

- Monitor, Evaluate, Maintain, and Stabilize Existing Levees and Identify Financing Plans
- Modify Agricultural Practices To Reduce Subsidence
- Investigate Techniques for Beneficial Reuse of Dredged Materials
- Establish and Identify Financing Plans for an Emergency Levee Management Plan
- Establish Habitat Corridors as Mitigation for Impacts from Maintenance and Stabilization of Existing Levees

Note: These actions are include in the first phase of the four common programs

ALTERNATIVE IDENTIFICATION

Action categories represent the building blocks of solution alternatives—that is, each solution alternative is a combination of action categories reflecting differing approaches to achieving program objectives and addressing solution principles.

Given the large number of these categories, and the range of perspectives on solutions to Bay-Delta problems among stakeholders and CALFED agencies, thousands of potential alternatives could have been identified. In response to this, a first step for the Program was to devise a methodology that would keep the number of alternatives to a manageable level while still representing the full range of approaches to resolving the problems.

The methodology chosen to accomplish this was to define the critical conflicts that exist between beneficial uses and resources in the Bay Delta and then to define approaches to resolving these conflicts. The conflicts were:

- *Fisheries and Diversions* The conflict between fisheries and diversions results primarily from fish mortality attributable to water diversions. This includes direct loss at pumps, reduced survival when young fish are drawn out of river channels into the Delta, and reduced spawning success of adults when migratory cues are altered. The effects of diversions on species of special concern have resulted in regulations that restrict quantities and timing of diversions.

- *Habitat and Land Use and Flood Protection* Habitat to support various life stages of aquatic and terrestrial biota in the Bay-Delta has been lost because of land development and construction of flood control facilities to protect developed land. The need for habitat affects land development planning as well as levee maintenance and planning. Efforts to restore the balance often require that land used for agricultural production be dedicated to habitat.

- *Water Supply Availability and Beneficial Uses* As water use and competition for water have increased during the past several decades, conflict too has increased among users. A major part of this conflict is between the volume of instream water needs and out-of-stream water needs, and the timing of those needs within the hydrologic cycle.

- *Water Quality and Land Use* Water quality can be negatively impacted by land use, and ecosystem water quality needs are not always compatible with urban and agricultural water quality needs.

In assessing these conflicts, alternate approaches to conflict resolution, and alternative levels of resolution, were defined. Approaches for resolving the fisheries and diversions conflict included (1) a fish productivity approach and (2) a diversion modification approach. Approaches for resolving the habitat and land use/flood protection conflict included (1) an existing land-use pattern approach and (2) a modified land-use pattern approach.

Approaches for resolving the water supply availability and beneficial uses conflict included (1) a demand reduction approach and (2) a supply enhancement approach. Approaches for resolving the water quality and land-use conflict included (1) managing the quality of Delta inflows and (2) managing instream water quality after discharges had occurred. Within each of these approaches, levels of conflict resolution ranging from less intensive to more intensive were identified.

This process produced 32 separate approaches to resolving the four conflicts. At this point, four teams of experts representing a variety of technical disciplines were formed—one for each conflict area. These teams were then assigned an equal number of the 32 approaches (i.e., eight apiece), and directed to develop approximately three preliminary solution alternatives—sets of actions and action categories—for each of the eight approaches.

This procedure identified 100 preliminary solution alternatives which have subsequently served as the foundation for the refinement process that defined the short list of three alternatives to go into Phase II analysis. In the Program's judgment, these 100 were representative of the larger number of possible combinations and sufficed to bracket the range of possible solutions to the four conflicts and, therefore, to the key problems facing the Bay-Delta.

ALTERNATIVE REFINEMENT

The 100 preliminary alternatives were very broad by design. Moreover, because they were crafted by teams representing the four conflict areas, they tended to address the four conflicts in varying degrees—that is, they were not necessarily balanced in addressing program objectives and solution principles.

In response, the teams were instructed to begin balancing their alternatives, and to refine the initial set to approximately 6 to 10 per area by combining those with similar characteristics. This produced a refined list of 31 alternatives.

At this point in the process, leadership responsibility for the four teams was moved from the technical experts to Program staff. This change was made to take advantage of staff's specific expertise on Bay-Delta issues and to more systematically include Program Team members in the process so as to ensure maximum sensitivity to the policies and positions of their agencies and stakeholder groups.

Continued consolidation and balancing of the alternatives brought the number to 20 and these 20 were subsequently presented to stakeholders, BDAC members, and the public at workshop 5. Consolidation and refinement based on input from that workshop produced the 10 alternatives described our *Phase I Progress Report*, April 1996. During April and May the Program conducted nine scoping meetings around the state, held workshop 6 in Sacramento, and convened a meeting of the Bay-Delta Advisory Council to discuss the 10 alternatives.

SCOPING

The CALFED Program EIS/EIR scoping period ran from April 8 through May 20, 1996. More than 700 Californians interested in Bay-Delta problems attended ten events including 8 scoping meetings, Workshop 6, and a public meeting in Los Banos. Listed below are the dates, locations and numbers of people who attended the meetings and Workshop.

Date	Location/Event	Attendance
April 8	Oakland/Scoping	47 people
April 9	Walnut Grove/Scoping	37 people
April 10	Red Bluff/Scoping	84 people
April 15	Sacramento/Scoping	37 people
April 15	Sacramento/Workshop 6	250 people
April 16	San Diego/Scoping	39 people
April 17	Long Beach/Scoping	23 people
April 17	Pasadena/Scoping	25 people
April 18	Bakersfield/Scoping	80 people
May 6	Los Banos/Public Meeting	110 people
	10 Events	732 people

The comments received during scoping cover a wide range of technical, policy, and financial concerns. Oral comments were generally consistent with comments contained in the over 160 letters received by the Program. Some of the comments prompted consideration of modifying the structure and presentation of the alternatives. These comments led to the conclusion that several components in the alternatives might be more appropriately treated as programs that must be included in all the alternatives. Some of these comments and our conclusions are:

The best possible source water quality is of paramount importance to urban water suppliers.

> Agencies that deliver drinking water are very concerned about the cost of meeting future drinking water quality standards, as well as the technical challenges associated with treating source water of degraded quality. This suggests strong pollutant source control measures in every alternative.

Delta levees will be needed to protect agriculture, infrastructure, and habitat no matter how water is conveyed in the Delta.

Delta levees protect many values including farms, habitat, infrastructure, and Delta water quality. Even if a new conveyance facility is built that protects water quality for some export users, adequate levee integrity will still be required to protect water quality and many other values in the Delta. This argues for a similar level of Delta levee protection in each alternative.

Ecosystem actions at the modest and perhaps the moderate level appear inadequate; the Program needs a single coherent vision of ecosystem restoration.

The restoration of ecosystem functions and the recovery of Bay-Delta species will likely require diverse actions that will be extensive in scope. There is really no alternative to a single comprehensive plan for restoring ecosystem health. Adaptive management will be vital in guiding efforts to improve ecosystem quality. It is this adaptive management that will provide the needed flexibility in the ecosystem restoration program.

Water use efficiency must be strongly pursued in all the alternatives.

This suggests that water use efficiency measures should be implemented at an increased level among all the alternatives, where previously some alternatives included efficiency at modest or moderate levels.

Water use efficiency is not the only component of the alternatives that will help meet water supply objectives; conveyance and storage components will also play an important role. In any alternative, these three components will need to be developed to complement each other. Thus, alternatives may take a common *approach* to water use efficiency but the level of effort may vary among the alternatives. The water use efficiency component must also be flexible in order to accommodate differences in local conditions and local needs.

In response to comments such as these, some components of the alternatives can be viewed in a different way. Water use efficiency, water quality, levee system integrity, and ecosystem quality could be viewed as *programs* that are present in all the alternatives, and are composed of a series of actions that are implemented at relatively high levels incrementally over time.

The remaining components, Delta conveyance and water storage, include the approaches that could vary by alternative. Distinctly different alternatives that cover the range represented by the ten draft alternatives could be formed by combining the four common programs with the two variable components. This general concept was confirmed by application of Solution Principles for alternative refinement and evaluation.

COMPONENTS OF ALTERNATIVES

Common Programs	Variable Components
Water Use Efficiency	Delta Conveyance
Water Quality	Storage
Levee System Integrity	
Ecosystem Restoration	

Based on this information, the fundamental structure of the alternatives was simplified. Preliminary Phase II Alternatives were formed around different configurations of Delta conveyance: Existing System Conveyance, Modified Through Delta Conveyance, and Dual Delta Conveyance. Each alternative includes the same set of four common programs related to water use efficiency, water quality, levee system integrity, and ecosystem quality. Storage for each alternative could be evaluated to support the common programs and the Delta conveyance and to seek a balance between attainment of program objectives and cost effectiveness.

In addition, the Program is working on strategies to sequence implementation of the alternatives into a number of phases over time. This phasing of facilities benefits assessment and financing and allows for "adaptive management" (i.e., the capability to adjust strategies and schedules based on benefits assessments, public input, and financing considerations) in guiding future implementation.

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Assumptions and Strategies

SOME GUIDING ASSUMPTIONS

As we have studied the hydrology and biology of the system, and as we have talked with stakeholders including individuals and organized groups, we have developed some fundamental assumptions about the Bay-Delta and the effects that our actions may have on the system. These assumptions are embodied in the preliminary Phase II alternatives. The assumptions will be studied and tested during Phase II to further our understanding of them, but the success of any comprehensive solution to problems of the Bay-Delta rests largely on the basic validity of these assumptions.

First, we assume that the importance of a unit of water in the system is not fixed, but varies according to the flow rate, the time of year, and the water year type. Thus, it is possible to increase diversion and storage of water during some high flow periods (while preserving peak flows that serve important functions in the system) in order to provide water supply for beneficial uses including ecosystem restoration. Some of this stored water can be used to augment outflow during dry years when there is keen competition for water. At these times water operations have their greatest impact on the ecosystem, and additional water is most needed by Bay-Delta species. In short, water can be diverted during high flow periods with relatively little impact on the system, and can be released at other times to produce great benefit to the system.

Second, we assume that a comprehensive program of ecosystem restoration will result in the improvement of ecosystem functions and the recovery of Bay-Delta species that are currently threatened, endangered, or of special concern. In addition to restoration of physical habitat, our efforts will include improved management of flows to help avoid the impacts that past water operations have had on the environment during critical periods. We assume that our ecosystem restoration actions will result in fewer constraints on the operation of water supply systems.

If our assumptions are correct we can manage water to take advantage of its time value, and we can restore ecosystem functions and recover species of concern. This will allow us to improve water supply reliability and create new opportunities to increase water supplies. If we can take advantage of the time value of water then we can develop new storage that will help meet water demands while it simultaneously reduces the impact of current water management practices. Successful ecosystem restoration could remove constraints that currently limit our ability to convey water supplies to users, as Delta species recover. Increased reliability and new supply opportunities will occur simultaneously with ecosystem restoration.

Our assumptions about time value of water and ecosystem restoration lead us to conclude that we can improve conditions for water users and the environment simultaneously, reducing conflict and achieving a lasting solution to problems of the Bay-Delta system.

SOME GUIDING STRATEGIES

The CALFED Bay-Delta Program has developed strategies in each of the four resource areas (ecosystem quality, water supply reliability, water quality, and levee system vulnerability) to guide the process of moving from objectives to alternatives. The strategies are based on the fundamental strategy developed earlier to carry out the Program's mission. The mission of the Program, as described previously, is to ***"Develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system."*** The Program's strategy to achieve this mission is to reduce the conflicts that exist over resources of the Bay-Delta. This calls for solving problems in all four of the resource areas concurrently. The following is a brief summary of strategies for the four resource areas:

> **Ecosystem Quality** - The primary ecosystem quality objective of the CALFED Bay-Delta Program is to "Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species." The Program's strategy to achieve this objective is to reverse the decline in ecosystem health by reducing or eliminating factors which degrade habitat, impair ecological functions, or reduce the population size or health of species. These factors may cause direct mortality of plants and animals in the system, but more often they result in indirect mortality by degrading habitat conditions or functions. For this reason, the Program objectives emphasize the improvement of habitats and ecological functions.
>
> **Water Supply Reliability** - The primary water supply reliability objective of the Program is to "Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system." Sub-objectives collectively increase water supply opportunities and reduce the conflict among beneficial water users, improve the ability to transport water through the system, and reduce the uncertainty of Bay-Delta system water supplies. The Program has a three-part strategy to reduce conflict and meet water supply reliability objectives. This strategy seeks to: reduce the mismatch between supply and beneficial uses; reduce the impacts that water diversions have on the Bay-Delta system; and increase the flexibility to store and transport water. System improvements including improved Delta conveyance and new storage can create new water supply opportunities for all beneficial uses including ecosystem needs and consumptive uses.
>
> **Water Quality** - The primary water quality objective of the Program is to "Provide good water quality for all beneficial uses." Among the four CALFED resource areas, problems and solutions related to water quality are perhaps the most varied. Good water quality means different things to different users, and there are different ways to achieve the objective. For instance, some constituents are of great concern to some

water users, but of no concern for other users: organic carbon from Delta soils can form carcinogenic treatment byproducts in drinking water, but this carbon does not generally pose problems for ecosystem quality. The Program's strategy to achieve the water quality objective is to improve source water quality by reducing or eliminating parameters which degrade water quality. The Program's water quality sub-objectives concentrate on this direct source control approach. At the same time, the Program acknowledges that source control alone may not be the best or only strategy to achieve good water quality for all uses.

Levee System Integrity - The primary system vulnerability objective of the Program is to "Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees." Failure of Delta levees can result either from catastrophic events such as earthquakes and floods, or from gradual deterioration. Subsidence of the Delta island peat soils and settling of levee foundations places additional pressure on levees and increases the risk of failure. The Program's strategy for achieving the system integrity objectives will be through implementation of a comprehensive Delta Levee Protection Plan to address long-term levee maintenance, stabilization, and emergency levee management.

Several additional strategies are required to achieve a workable solution:

Assurances and institutional guarantees must be considered relative to each alternative - The alternatives are described by their physical improvements to the Bay-Delta system including the intended operation. While these will be refined during Phase II analyses, a package of assurances and institutional guarantees are needed to ensure that each alternative can successfully operate as intended in the future. Each alternative will have a number of issues that require policy level assurances and guarantees for both the ecosystem and for the other beneficial water users. A BDAC Assurances Work Group has been established to identify these policy level responses. CALFED will consider the suggestions from the BDAC work group and will develop a package of Assurances/Institutional Guarantees to address these issues.

Assurances will be developed as part of the common programs - This will include assurances that the four program areas are implemented concurrently, or as concurrently as is feasible given the differences in timing opportunities. Assurances should also cover the design of an administrative structure to ensure adequate Program development, implementation, monitoring and adaptive management strategies. These will specify how the programs will be developed, reviewed, and approved over the decades of implementation.

Sequencing, or phasing, an alternative over time is important to success of the Program - Each alternative can be implemented in phases over time. This phasing offers the flexibility to apply adaptive management for fine-tuning the overall Program solution in the future as more information becomes available. Phasing also offers the opportunity to make the alternatives more affordable and implementable by financing costs over a period of time extending 20 to 40 years or more. In addition, phasing of the elements of an alternative can provide early implementation of actions that are well-defined or provide an early opportunity to reduce conflicts in the system.

Use adaptive management as an important element of each alternative - No long term plan for management of a system as complex as the Bay-Delta can predict exactly how the system will respond to our efforts, or foresee events such as earthquakes, climate change, or the introduction of new species to the system. Adaptive management acknowledges that we will need to adapt the actions that we take to restore ecological health and improve water management. These adaptions will be necessary as conditions change and as we learn more about the system and how it responds to our efforts. Pursuit of the Program's objectives will continue, but our actions may be adjusted over time to assure that the solution is durable. More detailed strategies for adaptive management will be developed by the Program team during Phase II. The BDAC work groups will identify policy issues related to adaptive management. The CALFED Program Team will consider the suggestions from the BDAC work groups and will include adaptive management in the package of Assurances/Institutional Guarantees for the Phase II Alternatives.

Alternatives Overview and Descriptions

As described previously, the scoping process and the alternative refinement led to a simplified structure for the alternatives. Each alternative includes the same four common programs related to **water use efficiency, water quality, levee system integrity, and ecosystem restoration**. Delta conveyance and water storage provide the primary differences between alternatives.

Each alternative will be composed of a different configuration of Delta conveyance, supported by the core actions and common programs. Storage, in a variety of sizes and combinations, will be studied to determine the combination of conveyance and storage which meets the Program objectives at the highest and most cost effective level for each alternative.

The results of scoping, agency review, and solution principle evaluation resulted in three primary Delta conveyance configurations (alternatives):

1. **Existing System Conveyance** where little or no modifications are made to the flow capacity of the existing Delta channels
2. **Modified Through Delta Conveyance** where a variety of modifications to Delta channels could be made to increase the conveyance efficiency
3. **Dual Delta Conveyance** where a combination of improved through Delta conveyance and conveyance isolated from Delta channels is used

The Phase II alternatives may be portrayed most clearly not as a discrete list of alternatives but rather as a matrix of the variable components combined with a set of relatively uniform common programs. The array of alternatives to be evaluated during Phase II may be portrayed using the matrix format shown below:

PHASE II ALTERNATIVES MATRIX

	Alternative 1	Alternative 2	Alternative 3
Conveyance Component:	Existing System Conveyance	Modified Through Delta Conveyance	Dual Delta Conveyance
Storage Component (Evaluated for Each Alternative):	Upstream Surface South of Delta Surface In-Delta Surface Conj. Use/Groundwater Bank.	Upstream Surface South of Delta Surface In-Delta Surface Conj. Use/Groundwater Bank.	Upstream Surface South of Delta Surface In-Delta Surface Conj. Use/Groundwater Bank.
Common Programs (Including Core Actions):	Water Use Efficiency Program		
	Water Quality Program		
	Levee System Integrity Program		
	Ecosystem Restoration Program		

The evaluations for the Dual Delta Conveyance (Alternative 3) will include extensive study of the isolated conveyance portion to find an optimal range of combined through Delta and isolated conveyance for this alternative. A dual conveyance subcomponent which has sufficient isolated conveyance capacity so as to be a functional equivalent of a fully isolated facility is included. This subcomponent would be subject to further analysis during the CEQA/NEPA review and more informed evaluation against the solution principles to determine whether that concept can satisfy those criteria.

Common Programs

The three Preliminary Phase II Alternatives are formed around different configurations of Delta conveyance. As described earlier, each alternative includes the same four common programs related to **water use efficiency, water quality, levee system integrity, and ecosystem quality**. Descriptions of each of these four common programs are provided on the following pages.

Each alternative could include some combination of storage to support the common programs and the Delta conveyance. A description of the variable **storage** component follows descriptions of the common programs.

Water Use Efficiency Common Program

Description

The Bay-Delta system provides the water supply for a wide range of instream, riparian, and other beneficial uses. As water use and competition among uses with respect to timing of water availability have increased during the past several decades, conflicts have increased among uses of Delta water which in turn have magnified the impact from natural fluctuations in the hydrologic cycle. Making more efficient use of water is an important way to reduce the mismatch between the available water supply and timing and the combined beneficial needs for that water.

Water use efficiency measures include various programs that seek to reduce the demand for water and increase the reuse of water in the system. These measures include agricultural and urban conservation as well as water recycling or reclamation. Water use efficiency may also be viewed as reaping the greatest benefit from each unit of water. Thus, an efficiency improvement may yield benefits in terms of water supply, or water quality, or ecosystem quality.

Upstream of the Delta, water use efficiency methods can make water available for other uses and help shift the timing of diversions for reduced impact on fisheries. South of the Delta (in the export area), water use efficiency methods can 1) make water available for other uses, 2) reduce the shortages that typically occur for many water users (environmental and other beneficial users) during extended droughts, 3) reduce diversions at times to provide some increase in Delta outflow, 4) increase the time before new facilities are needed, and 5) potentially allow for smaller sizing of new water facilities. Water use efficiency methods may help improve water quality or produce ecosystem benefits.

A number of comments received during scoping have led us to conclude that water use efficiency measures might be treated as a program with an uniform approach for all alternatives. Scoping comments related to water use efficiency include the following:

- Increased water efficiency may reduce opportunities for additional water use reductions during shortages, and increase the need for reliability
- Each alternative should have a stronger theme for water use efficiency
- Alternatives should recognize the difference between long-term conservation and shortage measures
- Water use efficiency needs to be preserved as a local implementation item
- There may not be any water use efficiency opportunities for additional reduction in many basins that are already at or near full efficiency
- Water pricing needs to be addressed more explicitly

The water use efficiency program will have a uniform approach for all alternatives that allows local water agencies to make appropriate water management decisions based on local conditions as well as changes in system conveyance and storage. The geographic or physical characteristics of a given alternative will affect how well the program performs. For instance, new storage can modify the operations and extend the effectiveness of water use efficiency.

Even with this uniform approach, the level of implementation could be somewhat different between alternatives. For instance, a higher level of conservation and reclamation may be appropriate with the existing system conveyance compared with the dual Delta Conveyance because of reduced opportunity to deliver Delta water south to the export areas.

The program will consist of actions or projects which are initiated in the first stage of the alternative with continued implementation over time. The program will include the core actions that apply to water use efficiency in the first stage. As implementation progresses, monitoring of effectiveness of the early stages will help refine later stages of implementation. The specific level of implementation will be defined during future phases of the Program by a combination of analyses and policy decisions.

<u>NOTE:</u> A BDAC Water Use Efficiency Work Group is assisting CALFED Program staff in identifying policy issues with respect to water use efficiency implementation. The Work Group will also help to identify techniques which encourage implementation of water use efficiency programs and integrated resource planning at the local level.

Implementation Methods

The following actions and implementation methods are in addition to the core actions. Measures to improve water use efficiency or reduce demand include the following:

<u>Urban Water Conservation Measures</u> such as Best Management Practices (BMPs). Greater urban water use efficiency may be achieved through implementation of BMPs by more municipal/industrial water suppliers and users, or by expanding the BMPs to include additional practices and higher implementation rates, resulting in less water use particularly in areas where the excess water is not returned for beneficial use. The level of

implementation of urban water conservation in any alternative will depend on storage and conveyance components of the alternative as well as conditions in particular service areas.

Agricultural Water Conservation Measures such as Efficient Water Management Practices (EWMPs). Greater agricultural water use efficiency may be achieved through adoption and implementation of EWMPs by agricultural water suppliers and users, and by implementation of on-farm practices, resulting in less water use particularly in areas where the excess water is not available for beneficial use (e.g., salt sinks). The level of implementation of agricultural water conservation in any alternative will depend on storage and conveyance components of the alternative as well as conditions in particular service areas.

Temporary and Long-Term Land Conversion
These actions are no longer being considered as demand management measures.

Water Recycling or Reclamation More efficient use of developed supplies may be achieved through water recycling. Urban wastewater recycling options include recharging groundwater, use for agricultural irrigation, recycling and treating for potable or non-potable urban use, use of grey water, and storage for use in meeting Delta flow standards. Agricultural recycling options include using drainage for irrigation purposes, while maintaining appropriate salt leaching requirements. Reclamation and reuse programs will focus on facilities that currently discharge treated wastewater into salt sinks or other degraded bodies of water. The use of recycled water will increase the overall availability of water and may reduce the amount of Delta exports at times. The level of implementation of water recycling in any alternative will depend on storage and conveyance components of the alternative as well as conditions in particular service areas.

The water use efficiency component of the CALFED alternatives will need to complement other components intended to meet water supply reliability objectives, including the conveyance and storage components. Although the specifics may vary according to the other components, the approach to implementation may be uniform across all the alternatives. Implementation of the water use efficiency program may be achieved in several ways. Ideally, local and regional water users will carry out integrated resources planning (IRP). This planning will examine all water supply and water use options available to the users. The process will take into consideration existing supplies, new opportunities created by CALFED storage and conveyance components, the cost of existing and new supplies, and the opportunities for water conservation and water recycling.

The best mix of these approaches will be selected to meet local conditions and needs. Other mechanisms may be used to ensure or to increase implementation of water use efficiency measures. Preferred mechanisms include incentives and disincentives (including economic incentives). Regulatory methods may also be used.

Relationship to Other Components

New Surface Storage, Conjunctive Use/Groundwater Banking - The effectiveness of water use efficiency methods can be enhanced by storage of the saved water for later use. For example, the groundwater banking and conjunctive use programs in Delta export areas such as the San Joaquin Valley and the Tulare lake Basin and in the Sacramento Valley could be expanded.

Through Delta or Dual Conveyance - Improved conveyance to the South Delta export pumps will help move water when it is needed. The opportunity for transfers will be increased, which will provide market incentives for implementation of water use efficiency actions.

Water Quality Improvements - Conversion of certain drainage-affected agricultural lands to other uses may reduce the pollutant load entering the Delta.

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of the water use efficiency program include:

- Reduces demand for Delta exports and related entrainment effects on fisheries
- Can help in timing of diversions for reduced entrainment effects on fisheries
- Could make water available for transfers
- May delay need (and size) for new water facilities
- May improve overall Delta and tributary water quality
- Could reduce the total salt load to the San Joaquin Valley

Potential concerns of the water use efficiency program include:

- Average year conservation may produce few critical year benefits unless conserved water can be stored
- Conservation may adversely affect downstream water reuse
- As conservation becomes an integral part of water management, it can reduce opportunities for additional water use reductions during shortages, and increase the need for reliability

Water Quality Common Program

Description

The Delta is a source of drinking water for millions of Californians and is critical to the state's agricultural sector. Appropriate water quality and sufficient nutrients are required to maintain the high quality habitat needed in the Bay-Delta system to support a diversity of fish and wildlife populations. Export water users require low salinity levels, and urban suppliers need low nutrient levels to maintain reasonable water treatment costs. A conflict over water quality in the system results from the fact that land uses often do not contribute to good water quality, and ecosystem water quality needs are usually, but not always, compatible with urban and agricultural water quality needs.

Pollutants enter the Delta through a variety of sources, including sewage treatment plant discharges, industrial facility discharges, and runoff from forests, farms and farm fields, mines, residential landscaping, urban streets, and natural sources, such as tidally-induced salinity intrusion into the system. Contaminants enter the system from upstream sources and from sources within the Delta. Natural seawater intrusion, exacerbated by diversion patterns, adds chlorides and bromides to exported supplies, and agricultural drainage adds chlorides and organic carbon. These constituents combine to produce potentially hazardous water treatment byproducts when subjected to municipal water treatment processes. Other constituents contributed by wastewater treatment plant discharges to system tributaries further complicate the pursuit of good raw drinking water quality for urban needs. The practice of drawing higher natural salinities and agricultural drainage to diversion points produces a self perpetuating cycle of increasing volumes of salt in exported water supplies.

The common program for water quality improvement will focus on pollutant source control. Reducing the total pollutant load entering the Delta will provide benefits for all water users. These include improved drinking water quality, reduced salt load for agricultural diversions, and improved water quality for the ecosystem, including reduced toxicity. Additional benefits can also be obtained by timing release of remaining pollutant discharges.

A number of comments received during scoping have led us to conclude that water quality improvements might be treated as a program that is generally uniform among the alternatives. Some of these comments are:

- The alternatives must address the issue of how each will obtain the best source of water for urban needs
- Alternatives should not suggest that the dilution of pollutant elements will satisfy the goal of improving water quality
- Each alternative should address salt and chemical recirculation
- Reduction of pollutants at the source should be a main focus of the Program
- The Program needs to address the San Joaquin drainage issue
- Alternatives must not degrade Delta water quality
- Degradation of water quality as water is transported through the Delta affects the

ability of urban agencies to recycle water
- Disinfection by-products resulting from bromides in Delta water is a concern for urban drinking water quality
- All alternatives must have improved and augmented water quality actions

While the water quality improvement component will be implemented at one comprehensive level for all alternatives, some minor adjustments may be needed depending on geographic or physical characteristics of a given alternative. For instance, the use of Dual Delta Conveyance may require more focus on in-Delta water quality than an alternative with only through-Delta conveyance. Water quality for urban use could also vary depending on the conveyance included with a given alternative. In each alternative, the program will be developed to provide the highest water quality considering all beneficial uses.

The program will consist of actions or projects implemented in stages over time. The program will include the original core actions that apply to water quality improvements in the first stage. As implementation progresses, information on effectiveness of the early stages will help refine later stages of implementation. The specific level of funding for implementation will be defined during future phases of the Program by a combination of analyses and policy decisions. The analyses will consider the costs of achieving various pollutant load reductions to the Delta and the costs of treating for drinking water.

The Program is addressing only the drainage issues that directly affect the San Joaquin River water quality. To that extent, the focus is on drainage management which reduce discharge of constituents and concentrations. Addressing the overall drainage issues in the San Joaquin Valley (some of which are not tributary to the San Joaquin River) are beyond the scope of the Program.

The Program will include incentives for local and regional agencies to implement watershed management. These incentives will encourage watershed management that promotes water quality in the tributaries to the Sacramento and San Joaquin rivers and/or promotes additional water supply. The watershed management techniques must be consistent with the ecosystem restoration program and principles of ecosystem health.

<u>NOTE:</u> A water quality technical group is assisting CALFED Program staff in identifying technical issues with respect to water quality implementation.

Implementation Methods

The following implementation methods are in addition to the core actions. Pollutant source control consists of actions to reduce discharges of water quality constituents of concern to aquatic habitats and water users in the Bay-Delta system and its tributaries. Implementation includes encouraging voluntary compliance for Best Management Practices and other measures that control sources of salinity, selenium, pesticide residues, and heavy metals as well as increased levels of implementation for water quality improvement. Examples of activities to improve water quality may include but are not limited to:

- Coordinate the development of efficient water quality management practices
- Coordinate the development of management programs and enforcement programs for source control of agricultural drainage to reduce leachate concentrations and volumes, restrict spray programs adjacent to waterways, reduce runoff volumes, and reduce concentrations of pollutants in runoff
- Construct wetlands to treat 10,000 to 15,000 AF of upstream wastewater effluent and Delta agricultural drainage
- Manage drainage timing (i.e., restrict drainage discharges by 60 to 70 percent during periods of low Delta inflow) to reduce instream impacts to water quality
- Improve management of urban stormwater runoff including increased Best Management Practices and by retaining and timing discharges (i.e., retain an additional 20 to 30 percent of runoff volume contained permanently)
- Provide economic incentives for land conversion to reduce costly water quality related drainage problems in the San Joaquin Valley
- Coordinate development of watershed protection programs (for water quality, ecosystem enhancement, and water yield).
- Provide incentives for filtration system upgrades and phased conversion of municipal treatment facilities from processes resulting in high disinfection byproduct precursors (DBP) discharges to processes that do not produce DBPs
- Mine drainage remediation measures developed in site specific studies at the Walker Mine, Malakoff diggins, etc. and provide an urban crediting system
- Actions to reduce effects of salinity in the San Joaquin River to maintain water levels and circulation in the south Delta and to reduce recycled salt load to the San Joaquin Valley
- Provide water for dilution of pollutant discharges remaining after above source control methods
- Treat 20 to 30 percent of agricultural drainage to remove pollutants, to either be reused or used as part of a localized drainage management practice

Relationship to Other Components

New Surface Storage, Conjunctive Use/Groundwater Banking - Storage can help timing for release of pollutants remaining after source control efforts.

Through Delta or Dual Conveyance - Improved conveyance to south Delta export pumps will improve water quality for those diversions but may decrease quality for in-Delta diversions.

Water Use Efficiency - Water use efficiency measures can improve water quality entering the Delta by reducing some agricultural drain water containing pollutants.

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of the water quality program include:

- Improves Delta water quality by reducing the volume of urban and agricultural runoff/drainage and concentration of pollutants entering the Delta
- Improves water quality for the ecosystem by reducing toxics as a limiting factor
- Improves drinking water quality and public health benefits
- Reduces concentration of compounds contributing to trihalomethane formation potential and degradation of drinking water supplies

Potential concerns of the water quality improvement program include:

- Retention of agricultural drainage and changing the timing of releases to the river and Delta does not change the total mass of salts recycled through the San Joaquin Valley irrigation system
- Treatment systems for agricultural drainage may be prohibitively expensive
- Wetland treatment systems may expose wildlife to toxic effects
- Source control actions for agricultural drainage may be prohibitively expensive for some agricultural interests
- Management of urban stormwater runoff may be prohibitively expensive and difficult to implement
- Need to study watershed management to determine potential for improving water quality
- Need to determine impacts or benefits to south Delta stage, circulation, and water quality

Other considerations include:

- Identify priority sources and provide regulatory and economically effective institutional incentives for implementation.
- Remediation actions should include consideration of surface regrading, revegetation, and hydraulic works for infiltration control, and mine drainage handling (e.g. discharge reuse, evaporation ponding, regulated discharge, rerouting) and treatment (e.g. mine sealing, limestone neutralization, etc.)
- Evaluate potential to give urban areas flexibility to fund high priority mine remediation in-lieu of increasing expenditures on wastewater treatment plant improvements.
- Retire lands that directly contribute to degraded water quality conditions in the Delta and its tributaries.
- Prioritize agricultural drainage sites for drainage management, such as west-side of San Joaquin Valley, Panoche Creek area, etc.
- Potential benefits of south Delta stage, circulation, and water quality actions to be verified.
- Evaluate the feasibility of developing additional water supplies on the San Joaquin River for water quality dilution.
- Wetland treatment should be initiated as a "pilot program" to establish its feasibility and expanded appropriately.
- Prioritize sources and pollutants of concern and direct enforcement activities accordingly.

Levee System Integrity Common Program

Description

The Bay-Delta system faces an unacceptably high risk of inundation of Delta islands due to potential levee failure, which can result in loss of land use, infrastructure and associated economies, damage to aquatic and terrestrial habitats, reduced water supply reliability, and reduced water quality in the Delta. Agricultural productivity and significant habitat for terrestrial species would be severely damaged by inundation of one or more Delta islands. In addition, increased salinity intrusion would likely cause significant impacts to aquatic freshwater habitat and water supply operations.

Improvements to Delta levees and channels are included in this common component to reduce the risk of failure due to floods, earthquake, and general deterioration of the facilities. These improvements to system integrity will be accomplished through development and implementation of the Delta Long-Term Levee Protection Plan. The plan will include a maintenance/stabilization element and a Special Projects element that collectively will address levee maintenance, stabilization improvements, subsidence reduction, an emergency levee management plan, beneficial reuse of dredged material, and establishment of habitat corridors as mitigation for impacts from maintenance and stabilization.

The Delta Long-Term Levee Protection Plan will provide a uniform approach for improving system reliability. Uniform funding and guidance for levee maintenance and/or improvements to a set standard would be provided on a cost-shared basis for Delta islands. Funding for flood control and habitat improvements would be on a prioritization system to ensure long-term protection of Delta system functions providing the highest public benefit.

A number of comments received during scoping have led us to conclude that system integrity might be treated as a program that is generally uniform among the alternatives. Some of these comments are:

- Most parties support an enhanced levee stabilization program
- A greater level of levee stabilization needs to be implemented (PL99) in all alternatives
- Flood control measures in the North Delta need to be included in all alternatives
- A consistent level of funding for levee maintenance needs to be provided
- A single regional authority to coordinate Delta system integrity actions needs to be implemented
- An emergency response program for all levee programs needs to be created
- Subsidence reversal as an integrated component of the program needs to be incorporated

While the system integrity component will be implemented at one comprehensive level with a high target achievement level, some minor adjustments may be needed depending on geographic or physical characteristics of a given alternative. For instance, a through-Delta alternative may use islands and channels for conveyance and thereby dictate how levees and channels in certain areas need to be improved.

The program will consist of actions or projects implemented in stages over time, perhaps 20 to 30 years, to ensure long-term protection and affordability. The program will include the core actions that apply to system integrity in the first stage. As implementation progresses, information on effectiveness of the early stages will help refine later stages of implementation. The specific level of funding for implementation will be defined during future phases of the Program by a combination of analyses and policy decisions. The analyses will include a risked-based benefit/cost analysis including consideration of converting land vulnerable to levee failure to areas of improved habitat.

NOTE: A system integrity technical group is assisting CALFED Program staff in identifying technical issues with respect to system integrity implementation.

Implementation Methods

The following implementation methods are in addition to the core actions. The Delta Long-Term Levee Protection Plan will consist of several elements. These elements will address levee maintenance and improvements to achieve a long-term goal of reducing the vulnerability of Delta functions throughout the Delta and identify stable funding sources. A strategic plan for Delta islands will be developed. The plan will prioritize work on highest priority sites anywhere within the Delta. High-priority sites would be identified through a ranking scheme that is expected to include criteria such as the protection of public infrastructure facilities (e.g., highways, pipelines, railroads), private infrastructure (e.g., homes, marinas), navigation (e.g., project/direct agreement levee systems), water quality at Delta export locations (e.g., west Delta islands), flood protection, cultural resources, recreation, and fish and wildlife. The elements include:

Levee Maintenance Plan - Establish a stable source of funding for levee maintenance and establish a uniform long-term Delta standard, including maintenance guidelines, which can incorporate habitat friendly levee maintenance procedures. Improve flood conveyance capacity of Delta channels through channel maintenance actions (e.g., maintenance dredging) or in conjunction with levee upgrades and improvements. These actions would reduce the vulnerability of Delta functions to inundation , improve flood capacity in high priority channels, and provide greater opportunities for habitat restoration.

Stabilization of the Highest Priority Western Delta Island Levees - Significant improvement in reliability of Delta water quality and the water conveyance system can be accomplished while incorporating aquatic habitat restoration and enhancement features. This can produce benefits in stabilizing fishery populations, complementing the increased certainty for water supply produced by the protections to Delta water conveyance tied to the levee stabilization.

High Priority Buffer Zones - Provide incentives for setting aside high priority buffer zones adjacent to levees of Delta islands with deep peat soils to control subsidence, maintain levee stability, and provide areas for habitat restoration. This land conversion may reduce demands on Delta water and reduce discharges of organics and other constituents into Delta channels. Additional more aggressive long-term subsidence reversal programs could be included for some islands, in coordination with the ecosystem restoration program.

Restoration of Highest Priority Habitat - This action can be integrated with efforts to establish buffer zones for subsidence control or implementation of mitigation banking opportunities for levee maintenance/improvement actions. Restoration efforts would be monitored for results and appropriate adjustments made in future restoration efforts.

Emergency Levee Management Plan - Identify a stable source of funding for an emergency levee management plan to address Delta levee failures through enhanced coordination of existing agencies and ensuring adequate availability of materials and equipment.

Relationship to Other Components

Through Delta or Dual Conveyance - Levee and channel improvements for conveying water to the South Delta export pumps should made in conjunction with flood control and aquatic habitat improvements.

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of the Delta Long-Term Levee Protection Plan include:

- Subsidence reduction helps long-term Delta system integrity
- Ensures suitable funding, equipment and materials availability, and coordination to rapidly respond to levee failures
- Provides funding for continued maintenance of levees to protect Delta functions
- Increased reliability for water supply needs from the Delta
- Increased reliability for in-Delta land use and habitat
- Increased reliability for in-Delta aquatic and wildlife habitat

Potential concerns of the Delta Long-Term Levee Protection Plan include:

- Providing increased levee stability and higher levels of flood protection in a staged fashion can expose adjacent islands to higher levels of flood risk until their priority is reached in the staged program
- Attempting to reach a uniform high level of flood protection may be prohibitively expensive
- Creating aquatic habitat as part of levee stabilization work may impact terrestrial habitats and vice versa
- Creating subsidence buffer zones may remove agricultural lands from production and

impact terrestrial habitats

- Improving flood protection in the North Delta may impact both aquatic and terrestrial habitats
- Without an adequate subsidence control plan, levee stabilization may not be successful over the long term in the peat soil areas of the Delta

Other considerations include:

- Determine extent and cost effectiveness of levee improvements and buffer zone programs.
- Buffer zones may be managed to provide wildlife habitat.
- Integrate protection and stabilization of levees with Delta habitat restoration and water transport activities.
- Channel improvements may include widening for improved conveyance, stabilizing berms, and related actions and should be integrated with levee improvements.
- Improvements to channels include dredging for sediment removal in channels with restricted flood capacity.
- Evaluate combination of floodway capacity and reservoir flood reservation.
- The Program anticipates convening a "blue ribbon" panel of seismic experts to evaluate seismic issues as they relate to CALFED Bay-Delta alternatives and provide advice to the Program Team.

Ecosystem Restoration Common Program

Description

CALFED is working to achieve a healthy Bay-Delta ecosystem that provides for the needs of plants, animals, and people using the system. This healthy ecosystem will include a range of sustainable habitat types that provide environmental, recreational, and aesthetic benefits. It will support natural production of an abundance of resident and Anadromous fish, including viable recreational and commercial fisheries. A healthy ecosystem will also support sustainable production and survival of plant and wildlife species, including resident species as well as migrants such as the waterfowl that use the Pacific Flyway each winter. These qualities are the benefits or ecosystem services that a healthy Bay-Delta ecosystem will provide.

To be sustainable, fish, wildlife, and plant populations depend on an ecosystem that provides all the natural processes, called ecosystem functions, that they need. Though the Bay-Delta system will never be returned to the conditions that existed prior to human disturbance, ecosystem functions will be restored to levels needed to support Bay-Delta species at natural sustainable levels and at levels where they will not be threatened or endangered with extinction. A healthy functioning ecosystem will include all the habitats necessary for survival of species that use the system, including for example freshwater and brackish tidal marsh, shallow water, riparian woodlands, and shaded riverine areas. These habitats will be large enough in area to support sustainable populations of Bay-Delta species, and will be interconnected to allow movement and prevent isolation of plant or animal populations. To the extent possible, natural processes of the system will be restored, including for example proper water flow to ensure appropriate salinity levels, meander belts that create necessary habitat and generate sediments that are important to the system, and nutrients that support the food web of the system. Human pursuits that affect the Bay-Delta ecosystem will be managed to complement ecosystem health, maintaining water that is free of toxic contaminants, and encouraging agricultural land uses that are compatible with wildlife.

A number of comments received during scoping have led us to conclude that ecosystem restoration might be treated as a program that is generally uniform among the alternatives. Some of these comments are:

- The Program needs to expand watershed management techniques and actions as part of overall effort
- The Program needs to clarify and elaborate restoration definition, goals, objectives, etc. (need a more fully developed plan)
- Will the Program address overall increases in Delta outflow? Will this be explicit in the restoration activities?
- The Program needs to discuss outflow enhancements and instream flow requirements
- The Program needs to develop a broad vision and a high level ecosystem restoration plan and make that common to all alternatives
- The Program needs to develop guarantees that the ecosystem actions will be effective
- More habitat needs to be added to reduce conflict and increase durability
- A more intense fish screening program needs to be added to reduce conflict and increase durability

While the ecosystem restoration program will be implemented at one comprehensive level, some minor adjustments may be needed depending on geographic or physical characteristics of a given alternative. For instance, habitat restoration activities could be located differently, depending on use of through-Delta or isolated conveyance (e.g., if the south Delta export pumping continues from existing channels, then fisheries habitat would probably not be restored near the pumps).

The program will consist of actions or projects implemented in stages over time. The program will include the core actions that apply to ecosystem restoration in the first stage. As implementation progresses, information on effectiveness of the early stages will help refine later stages of implementation. The specific level implementation will be defined during future phases of the Program by a combination of analyses and policy decisions.

<u>**NOTE:**</u> A BDAC Ecosystem Restoration Work Group is assisting CALFED Program staff in identifying key policy issues with respect to restoration of ecosystem health.

Implementation Strategy and Methods

The Program's strategy is to reverse the decline in ecosystem health by reducing or eliminating factors which degrade habitat, impair ecological functions, or reduce the population size or health of species. The Program will focus on those factors that cause direct mortality of plants and animals in the system, or cause indirect mortality by degrading habitat conditions or functions. Program objectives reflect this strategy. In addition the strategy also emphasizes the following.

Limiting Factors When there is a single factor limiting an ecological function or species, remedial actions are often clear. However, there are many stressors that reduce ecological functions or cause mortality of species in combination or at different stages in the species life cycle. Often the processes are complex and poorly understood. In the Bay-Delta system, some of these include inadequate physical habitat for reproduction, foraging, or escaping from predators; inadequate water quality including temperature and toxic contaminants; fragmented habitat that impedes migration; inadequate or altered water flow regimes; direct and indirect mortality caused by water diversions from the system; the presence of undesirable introduced species that compete with or prey upon other species; recreational and commercial harvest; and or even such factors as recreational boating. In cases where there are multiple stressors affecting species, the strategy of the Program is to take a broad ecosystem approach, making incremental improvements in all the significant identified factors that affect important species and their habitats.

The Program will start by addressing factors likely limiting species of special concern such as winter and spring run chinook salmon, delta smelt, and Sacramento splittail. Subsequent efforts will work to protect or restore other ecosystem functions. Actions will be guided toward de-listing these species as threatened or endangered.

Natural Processes With limiting factors as the focus of the program, there will be need to select actions that favor those factors that take advantage of natural processes to achieve desired results. This will reduce the amount of effort necessary to sustain restoration benefits, and increase the likelihood of long-term success of the program.

Resilience Actions will be prioritized by their ability to restore some of the system's natural resilience to disturbance. Habitat restoration will be directed toward natural processes such as river meander belts that are self sustaining. Actions will also be spread throughout the system, to ensure genetic diversity will be protected for species with widespread distributions.

Achieving Multiple Benefits Efforts will be made to increase benefits by selecting or designing actions that improve habitat conditions or ecological functions for multiple species. Actions will also be favored if they improve other resource areas including water quality, system integrity, and water supply reliability as well as improving ecosystem quality.

Measurable Results Program results will be measured through monitoring and research. Actions will first be designed and implemented so that their effectiveness is measurable. The

Program will include monitoring to assess the overall success of actions implemented. This will allow adaptive management of the restoration effort: adjustment of our actions to make them more effective, and changes in emphasis as the condition of the ecosystem improves.

Adaptive Management Where uncertainty exists in how to implement actions or on potential benefits, adaptive management will guide the program. Actions will be implemented on a pilot scale to refine uncertain techniques and to measure previously unknown potential success. The Program will adjust as necessary to achieve objectives. In many cases natural variability in the ecosystem will also force Program adjustments.

Make up for Unavoidable Losses Where competing uses of Bay-Delta resources make it impossible to avoid indirect affects on species, habitats, or ecological functions, efforts will be made to compensate by reducing other causes of mortality or improving habitats and functions elsewhere in the Bay-Delta system.

Specific Restoration Program Actions

Sacramento River: Habitat restoration in the upper Sacramento River would include the following:

- protection and enhancement of the remnant natural meander belt from Redding downstream to Chico Landing,
- maintenance of adequate flows for fish spawning, rearing, and migration,
- restoration of spawning gravel habitat for salmon and Steelhead from Keswick Dam downstream to below the Red Bluff Diversion Dam,
- reductions in the amount of toxins released into Spring Creek and the upper Sacramento River from the Iron Mountain Mine,
- improvement in water temperatures below Keswick Dam through installation of temperature control devices on Whiskeytown and Shasta Dams,
- improvements in riparian habitat through setback levees from Chico Landing to Verona, and
- improvement in the riparian and aquatic habitat and drainage systems in the Yolo and Sutter bypasses,
- reductions in fish losses at diversions from Keswick Dam downstream to the Delta.

Sacramento River Tributaries: Habitat restoration in the Sacramento River tributaries would include the following:

- comprehensive improvement in riparian and aquatic habitat,
- removal of barriers to migration,
- improvement in flow conditions, and
- reductions in fish losses at diversions

San Joaquin River: Habitat restoration in the San Joaquin River would involve the following:

- improvement in channel habitat conditions upstream of the Delta,
- reductions in fish losses at diversions, and

- improvements in flows for fish spawning, rearing, and migration.

San Joaquin River Tributaries: Habitat restoration in the San Joaquin River tributaries would include:
- better management of flows and pulse flows,
- improvements in riparian habitat and vegetation,
- restoration of natural processes or artificial maintenance of physical habitat such as spawning gravels,
- reduction in fish losses in diversions, and
- improvements in channel habitat configurations.

Bay-Delta: Habitat restoration in the Bay-Delta would include the following:
- conversion of substantial acreage of leveed land to tidal wetlands and shallow aquatic habitat in Suisun Marsh and the Delta,
- restoration of Delta riparian and shallow water habitat along levees,
- protection and enhancement of riverine habitats on channel islands,
- protection and enhancement of existing tidal wetlands,
- reductions in fish losses at diversions,
- improvements in flows through and out of the Delta, and
- protection and enhancement of agricultural land uses and practices that support wildlife.

Control of Introduced Species - Improved control of introduced species to help prevent introductions and to help protect and enhance the natural ecosystem values of the Delta by reducing competition.

Fish Screens and Facilities - Priorities for fish screening needs for existing Bay-Delta system diversions will be developed and included in the common Ecosystem Restoration program for each alternative. This will include screening needs within the Delta and on the upstream Sacramento and San Joaquin rivers and tributaries. In addition, new screens will be considered for the new through Delta diversion from the Sacramento River in Alternative 2. New screens will be considered for both the isolated and the through Delta diversions from the Sacramento River in Alternative 3. For all three alternatives, fish screen improvements are included at existing Project Pumps.

The agency ecosystem review team will develop fish screening criteria considering existing criteria of California Fish and Game, National Marine Fisheries Service and the U.S Fish and Wildlife Service. These criteria will include physical parameters (velocity, bypass requirements, etc.) for the screens and the previously mentioned priority listing of diversions needing screening. The criteria and priority for screening will be included in the common Ecosystem Restoration Program in each alternative.

Fish Protection and Management - Improving protection and management of fish in the Bay-Delta system are important to sustaining healthy populations. These involve management of spawning gravels, modification of barriers that restrict fish passage and migration, use of real-time monitoring and adaptive management, management of hatchery fish, and improving data management for regulation of fish harvest.

Indicators and Targets for Ecosystem Restoration - Indicators are factors to be measured in a monitoring program to provide a measure of progress. Bench-marks that indicate performance (good or bad) will help establish specific target levels. CALFED will draw on the strengths of several approaches to set targets. These include: evaluation of pre-disturbance conditions and processes, the use of diagnostic goals and prescriptive actions to manipulate controlling factors which limit ecosystem products, and the use of a recent historical reference period. A period can be used to quantify ecosystem products such as populations, ecosystem conditions such as acres of habitat, and ecosystem functions such as nutrient input. Complementary to these approaches is the suggestion that declines in the fish populations over the last third of a century is the problem which necessitated the CALFED effort. An identification of the probable causes of these declines could lead to the most effective prescription for restoration of balance between competing uses.

Adaptive Ecosystem Management
Ecosystem management is the process of taking actions to preserve, sustain, enhance, and restore ecological resources and human needs of an ecosystem such as the Bay/Delta. "Adaptive" Ecosystem Management is adjusting this management process as the process unfolds and results are obtained. It is an interactive approach to decision making. It involves a cycle of goal setting, describing actions to achieve those goals, planning, implementation, monitoring, research, and subsequent reexamination of the actions. Ecosystem managers assess information gathered from monitoring and research and adjust plans if necessary. In the ecosystem health vernacular, ecosystem managers diagnose, treat, monitor response to treatment, and then adjust the treatment regime.as needed.

Adaptive management is a process that should involve stakeholders and resource managers working together in redirecting program actions in response to changing social, economic, and ecological information. Because of the difficulties and uncertainties involved in ecosystem management, adaptive management has been suggested and widely adopted as the standard approach to ecosystem management. Adaptive management is a key component of ecosystem management as it provides a decision support system for stakeholders and resource managers. It deals with uncertainties of implementing ecosystem management through the conduct of focused experiments with rapid feedback of information.

Key elements essential to a successful adaptive management program are goals/objectives and a monitoring plan. Program goals and objectives should be well defined, and should not be adjusted in the event success is not achieved, only the implementation approach should be changed. The state of health the program hopes to achieve should not change, only the treatment program need be changed to ensure health goals are achieved. Monitoring data are examined and reexamined with these goals and objectives in mind.

Effective adaptive management requires well-defined success criteria; long-term comprehensive monitoring plans; comprehensive restorations plans; and a cooperative management team.

Adaptive management is a necessity of the CALFED Bay-Delta Program, because of uncertainties with regards to the causes of the ills of the Bay-Delta ecosystem and the inability to predict responses to proposed remedies and actions. A substantial number of the CALFED proposed actions will necessarily be implemented as "experiments" because of highly uncertain outcome and benefit. Actions may have a specific targeted resource, but the response is uncertain. For example, identified declines in many fish populations have been related to combination of diverse factors with the cause-and-effect mechanisms and roles of each factor being relatively unknown. Fish declines coincide with changes in flow and habitat conditions; the specific role of each is unknown. Experiments will be needed to direct the program in the direction of actions that provide the best return to the fish populations.

Because of the difficulties in answering these questions, the program will proceed based on available information and theories. Adaptive management will test these theories through trial and error experiments, rather than the wholesale implementation of actions. Testing will take the form of pilot studies or experiments.

<u>Real Time Monitoring</u> - Real-time monitoring is the continuous observation in multiple locations of biological conditions on site in order to adjust water management operations to protect fish species and allow optimal operations of the water supply system. If an effective monitoring system can be developed it will benefit both the ecosystem health and the water supply. A few years of field studies have been completed using real-time monitoring which demonstrate its potential as a management tool. However, real-time monitoring for fisheries management requires further refinement and evaluation to determine to what extent it can be relied on as a water and fisheries management tool.

<u>Subsidence Reversal and Delta Habitat Restoration</u> - During Phase II component refinement, the Program will study a full range of habitat restoration options in the Delta. The range will include options which become available if the less sustainable Delta levees are not maintained indefinitely.

The Program will include in its alternatives, a set of targets to meet ecosystem goals and an adaptive management approach to Delta habitat restoration and system integrity. To aid in this effort the Program will also convene an expert panel to provide advice on long-term sustainability of Delta habitat and infrastructure. The panel will be asked to consider subsidence reversal and Delta habitat restoration in the target-setting and adaptive management approach. This may yield a mix of actions that allow for the gradual, phased, large-scale restoration of leveed islands to a mixed mosaic of uses emphasizing high quality habitat, including tidal marsh, managed wetlands, terrestrial and upland habitats, agriculture, waterfowl forage crops, and shallow and deep water recreation, with the local economic benefits associated with all of these uses.

The expert panel will focus on a planning area including all the islands which are potentially tidally influenced. To define the recommended areal extent of this habitat restoration component, the Program will examine such factors as: (1) the environmental and economic costs and benefits resulting from major conversion of land to environmental purposes; (2) the long-term sustainability of the Delta islands, given the economics of farming, the risks of permanent flooding from seismic and other causes, and the costs of levee maintenance and repair and subsidence control; and (3) the long-term feasibility of restoring productive aquatic habitat on islands where substantial subsidence has occurred.

Relationship to Other Components

New Surface Storage, Conjunctive Use/Groundwater Banking - Storage can improve instream flows, Delta outflows, and modification of timing of diversions.

Through Delta or Dual Conveyance - Improved conveyance to the south Delta export pumps can improve timing of diversions to reduce impacts on fish.

Water Quality Improvements - Water quality improvements through source controls and timing of remaining pollutant releases improves water quality and reduces toxicity for the ecosystem.

System Integrity - Improvements of levees and channels for improved system integrity can also incorporate new habitat features.

Water Use Efficiency - Reduced diversions associated with water use efficiency measures helps reduce diversion effects on fisheries.

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of the habitat restoration program include:

- Reversing the decline in ecosystem health by reducing or eliminating factors which degrade habitat, impair ecological functions, or reduce the population size or health of species
- Produces a healthy Bay-Delta ecosystem that provides for the needs of plants, animals, and people using the system
- Supports sustainable production and survival of plant and wildlife species, including resident species as well as migrants such as the waterfowl that use the Pacific Flyway each winter
- Reduces the conflict between fisheries and diversions

Potential concerns of the habitat restoration program include:

- Setback levees along the Sacramento and San Joaquin Rivers may remove agricultural land from production
- Care needs to be taken so as not to increase flood risk to downstream areas

- Restoration of riparian habitats adjacent to levees may increase the difficulty of maintaining safe and stable levees and may increase risk of levee catastrophic failure
- Reestablishment of river meander zones may increase sediment loads in the short-term and impact downstream navigation channels; sediment loads may also increase maintenance costs for flood bypass systems
- The enhancement of fishery populations may require reconsultation pursuant to the Endangered Species Act; (e.g., increased Delta smelt around the North Bay aqueduct)
- Floodway conversions to habitat may increase maintenance costs or impair floodway capacities; there may also be impacts to agricultural acreage
- Depending on how the program is implemented, actions to address salmon migration at the head of Old River may impact water stages and quality as well as flood stages in the south Delta channels
- There is uncertainty about implementation level and experience needed to achieve desired results
- Water supply reliability improvements resulting from ecosystem restoration could take considerable time to achieve

Other considerations include:

- Actions are intended to maintain recreational and commercial fisheries as well as enhance native salmon stocks.
- Habitat restoration must not impair capacity of flood ways.

- Select diversions for screening according to criteria including size of intake, location, peril to fish, and screening feasibility.
- San Joaquin environmental water can be used for pulse flows for fish transport or diluting poor quality flows

Storage Component

Description

The Bay-Delta system provides the water supply for a wide range of environmental, agricultural, and urban beneficial uses. As water use and competition among uses with respect to timing of water availability has increased, conflicts have increased among uses of Delta water. Adding more storage is a possible action in each alternative. Surface storage of water and conjunctive use/groundwater banking can be used to greatly increase the opportunities to improve the timing and availability of water for all water users. The benefits and impacts of surface and groundwater storage vary depending on the location, size, operational policies, and linkage to other components. Depending on the configuration of the alternative the benefits and impacts may be very different between storage located upstream of the Delta, in-Delta, and south of the Delta.

By regulating flows, surface or groundwater storage could optimize the capacity and operation of the existing system conveyance. South of Delta storage would allow increased

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permitted pumping capacity to be used during acceptable periods. During other times, water users would draw on the storage and export diversions could be reduced. Releases from north of Delta storage could be used for diversions and to manage the river flows. Storing water during periods that would not impact fisheries improves the ability to shift pumping to less sensitive periods. In-Delta storage would provide similar benefits. To protect Delta outflow, expanded in-lieu groundwater banking in the southern San Joaquin Valley and other areas dependent on Delta supplies could help reduce demands for surface water in dry years.

Many of the comments received during scoping and at Workshop 6 focused on the need for increased emphasis on storage for better water supply and flow management. Some of these comments are:

- The alternatives do not appear to increase overall supply of water. Current wording could be interpreted that exports could be cut in half and still meet CALFED Bay-Delta Program goals
- All the alternatives need to acknowledge the need to free up Delta constraints before storage can be effective
- Alternatives need to include expanded existing storage as a high priority (raise dams)
- Alternatives should provide more storage options
- Alternatives should prioritize conjunctive use first, then groundwater banking, then surface storage
- Alternatives should address the problem of groundwater overdraft in the southern San Joaquin Valley
- Conjunctive use is more acceptable in alternatives when practiced in a local area. Assurances of non degradation of local ground water supplies need to be provided if practiced on a State wide basis

Due to the importance and complexity of these issues, we have created a separate component for storage that requires additional analyses to refine sizes and operations. Unlike the common components discussed above, storage will be variable component that could differ with each alternative. Storage will be a variable component with surface and conjunctive use/groundwater banking elements.

Surface storage (in Sacramento River basin, San Joaquin River basin, export areas) can be either new or a modification of existing storage, each with different benefits and potential adverse impacts. Opportunities for increased conjunctive use in the Sacramento basin and groundwater banking in the San Joaquin basin need to be quantified to determine the benefits and potential adverse impacts.

To determine the optimum combination of surface and groundwater storage for any alternative, a full range of size, locations, and operational polices must be examined in Phase II. Shared use of storage for environmental, water supply, and water quality will be optimized to determine the greatest benefit from the storage and other components of the alternative. Combinations of storage elements in a variety of sizes for each conveyance method and capacity will be studied to determine the combination of conveyance and storage which meets the program objectives at the highest and most cost effective level.

Implementation Methods

The following implementation methods are in addition to the core actions. Surface storage can be constructed off-stream upstream of the Delta, off-stream in the Delta, or off-stream south of the Delta. Conjunctive use/groundwater banking operations and impacts vary with configuration and location.

While no detailed analysis has yet been conducted, the Program staff has assumed a general order of implementation starting with conjunctive use and continuing with groundwater banking, offstream surface storage, and on-stream surface storage as needed to meet storage requirements of a given alternative. This order is based on staff's perception of the ease of permitting and the time required to bring a facility on line. Both expansion of existing facilities and providing new facilities for each of these types of storage will be considered. We believe that the Program's commitment to multiple objectives, which include ecosystem health, requires that instream surface storage be given a lower priority than the other three options for the storage component. Refinements in this assumed order of implementation will be made as the storage evaluations in Phase II of the Program progresses.

Upstream Surface Storage - Runoff from precipitation north of the Delta usually occurs in large volumes over short periods of time in the winter and spring. New upstream off stream storage would capture a small portion of flows in excess of instream flow requirements and water supply needs. Water would only be diverted to the new storage following the peak flood flow, maintaining the beneficial geomorphologic effects of the highest flows. Water would be released when needed to supplement instream flows and for water supply. For example, water in north of Delta storage could be released directly to current north of Delta water users, reducing existing diversions from the Sacramento River. Water released for environmental purposes could include pulse flows to help transport fish through the Delta. Water could also be released to provide sustained flows for riverine and shallow water habitats and improve water quality in the Delta, particularly in dry years. Examples of upstream storage could include the off-stream Colusa-Sites Reservoir (0.5 to 3.0 MAF) or enlargement of existing Lake Berryessa Reservoir.

In-Delta Surface Storage - In-Delta storage could be developed by converting one or more Delta islands into reservoirs. Existing levees would be reconstructed, and screened facilities for diverting water into the island would be provided. In-Delta storage would be filled during wet periods when probable harm to critical fishery resources would be lowest. Water would be released directly into the Delta for environmental, water supply, and water quality needs or connected directly to the export facilities to provide flexibility in diversion timing. New environmentally dedicated Delta storage reservoir could be located near export pumps on one or more islands such as Bacon, Mandeville, or Victoria. Water would be diverted into storage during November, December, and January and released in March to July as Needed. Real-time monitoring might guide operations to divert when species of concern are not present and release water to move fish away from diversions. A wide riparian and shallow water habitat corridor could be created around the perimeter of the Delta island storage to provide additional fish and wildlife benefits. If the stored water was to be used for municipal water supply, the need to remove or seal organic soils on reservoir islands to avoid release of carbon into stored water would require evaluation. Foundation and slope stability considerations may limit the daily drawdown of in-Delta storage, requiring higher amounts of storage. In Delta storage could range from 100 to 600 TAF and could be linked to Clifton Court Forebay, linked to an isolated facility, or could be separate from these. More analysis and review of the technical issues of in-Delta storage is needed in Phase II of the Program.

South of Delta Surface Storage - South of Delta storage would be filled by diversions which supply the Delta Mendota Canal or the California Aqueduct. Examples of existing south of Delta storage are San Luis Reservoir and Castaic Lake. Storage would be filled during wet periods of least potential harm to Delta fishery resources. With water in storage south of the Delta, export pumping could be curtailed at times of heightened environmental sensitivity.

Conjunctive Use - Conjunctive use is the management and operation of a groundwater basin in a manner similar to on stream reservoir operations to provide limited short-term flexibility in meeting water supply demands. Groundwater is removed and subsequently recharged over a period of years or within a particular year. Groundwater levels would tend not to drop drastically as a result of constant recharge from rivers and streams as well as direct recharge. In addition, groundwater levels would not tend to rise significantly above historic levels because of loss to river accretion. During drier periods, groundwater would be extracted for use in place of or to supplement surface water supplies within the region. In wetter periods, river and stream seepage as well as direct recharge would return the groundwater levels to previous equilibrium conditions.

Groundwater Banking - Groundwater Banking is the storage of water in existing depleted groundwater basins and the subsequent extraction and use of the stored water to meet water supply demands. Typically, large quantities of water can be stored in such basins. During wet periods, surface water would be delivered to these basins and stored for a period of months or years. During drier periods, the storage would be extracted and used in place of or to augment surface water supplies.

Operations

New storage could be sized to provide for multiple uses with each alternative. New surface storage upstream and downstream of the Delta could provide greater flexibility in timing inflows to the Delta and diversions from the Delta. Downstream storage, in conjunction with groundwater/conjunctive, use could be used to better manage the timing of Delta exports. Evaluations will be performed by fishery experts to determine the relative importance to the fishery of the various windows of time available for pumping during the year. Pumping operations will be crafted to fit pumping within the windows of least impact to fisheries (e.g., late fall and early winter). Pumping curtailments will be designated for the windows of highest importance to the fishery (e.g., March through June).

New upstream and downstream storage could be operated to fill during the receding limb of peak flood hydrographs, which would be unregulated by existing on-stream storage facilities.

Down stream storage would be filled as much as possible utilizing the isolated facility if part of an alternative. Detailed analyses of hydrologic and biological conditions will be required to determine the impacts and criteria for filling storage in this manner.

Average and Wetter Year Operation

- Environmental storage could be conserved to the extent possible in average and wetter years. Water remaining in storage above established carry-over targets will be transferred to groundwater banking and conjunctive use areas to supplement long-term and drought period supplies.

- Water supply storage in the new facilities could be used on a seasonal basis to allow a shift in Delta withdrawals from the March through June period to less environmentally sensitive periods. Water remaining in storage above established carry-over storage targets will be transferred to groundwater banking and conjunctive use areas to supplement long-term and drought period supplies.

- Excess carry-over storage in Shasta and Oroville would be transferred to groundwater banking and/or conjunctive use areas. Vacating this water from on-stream project reservoirs could enable a greater portion of flood flows to be captured and stored.

Dry and Critical Year Operation

- There will be significantly reduced opportunity to fill either upstream or downstream storage, since flood events are generally much smaller and more infrequent during these years.

- The portion of storage allocated to environmental purposes upstream of the Delta could be used to increase Delta outflows during the late spring and summer period and as otherwise needed to improve ecosystem functions in the Delta. Environmental storage to the south of the Delta could be used to offset Delta withdrawals. Storage withdrawals for consumptive demands would be provided in exchange for upstream releases from water supply storage which would remain in the Delta as outflow.

Relationship to Other Components

Conveyance improvements and conveyance facilities could complement new storage. Conjunctive use and groundwater banking programs could be improved by the addition of surface storage.

<u>Conveyance</u> - Conveyance modifications would increase the ability to convey water from north of the Delta to south of the Delta at environmentally acceptable times. Upstream surface storage would accommodate shifts in export diversion timing by storing water until it can be diverted. Water would then be released to the conveyance facilities. Water could also be stored and released to manage Delta outflows. South of Delta storage would permit the increased conveyance capacity to be used during acceptable periods. During other times, water users would draw on the storage and export diversions would be reduced.

Conjunctive Use/Groundwater Banking - Groundwater recharge and extraction facilities could be optimized if new surface storage is used to regulate flows into and out of the groundwater basin.

Water Use Efficiency - Storage improves the flexibility for better management of water conserved through water use efficiency measures.

Water Quality Improvements - The timing of releases from storage can greatly improve water quality at critical times.

Ecosystem Restoration - All types of storage facilities increase the flexibility to help manage the downstream flow for environmental purposes.

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of surface storage and conjunctive use/groundwater banking include:

- Flexibility to coordinate supply opportunities
- Dry period supply opportunities
- Enhance environmental flows (shift water use patterns for habitat and fisheries)
- Management of downstream water temperatures
- Increase annual supply opportunities
- Enhance water transfer opportunities
- Flexibility to reduce entrainment (timing of diversions)
- Opportunities to improve timing of Delta outflow
- Increased flood control
- Increased recreational benefits
- Increased power generation
- Opportunity to improve water quality
- Opportunities to improve fish transport through the Delta

Potential concerns of surface storage and conjunctive use/groundwater banking include:

- Hydrologic and biologic studies are required to identify criteria (quantity and timing windows) for diversion of water to storage
- Reduced total Delta outflow, though outflow can be increased during critical periods for ecosystem health
- Increased total diversion rate in particular flood flow periods
- Potential increased Bay stratification impacts
- Site specific terrestrial and wildlife impacts
- Potential loss of culture resources
- Water quality impacts
- Adverse effects of land use change
- Decreased gravel recruitment

- Increased average and above year surface deliveries
- Terrestrial impacts in dry and critically dry years
- Potential impacts on adjacent groundwater users

Other considerations include:

- Conjunctive use and groundwater storage programs can include in-lieu operations which focus on providing adequate deliveries of surface water in wet years and lower deliveries in dry years. Groundwater stored south of the Delta would be used in-lieu of surface deliveries during dry years and seasonally to marginally offset Delta exports during fish sensitive periods.
- Groundwater storage may take the form of in-lieu recharge or direct recharge using injection wells or recharge basins.
- A portion of storage will be managed for in-Delta fisheries or other Bay-Delta environmental purposes.

Alternative 1

Conveyance Variable:	**Existing System Conveyance**
Storage Variable:	**Upstream-, South- and/or in-Delta storage** **Conjunctive use/Groundwater Banking** (may include a range between no storage or any combination of these)
Common Programs:	**Water Use Efficiency** **Water Quality** **Levee System Integrity** **Ecosystem Restoration**

Conveyance Variable

Continued use of existing Delta conveyance system

This alternative uses the existing Delta channels for conveyance. The channels could continue to be maintained in their current configuration with Delta exports subject to the current permitted south Delta pumping limits. However, increasing the permitted capacity of the pumps, for specific windows of time when fishery impacts are lowest, will be investigated in increments up to the full physical capacity of the pumps. The higher permitted capacity may require selective south Delta channel improvements to eliminate high channel velocities under certain flow conditions. This alternative could somewhat reduce fish entrainment losses by decreasing diversions from the Bay-Delta watershed during environmentally sensitive periods when fish are more vulnerable.

Storage Variable

Study combinations of storage and conveyance

Studies during the next phase of the Program will determine what storage, if any, could be beneficial to the alternative when teamed with the conveyance and common programs. Combinations of storage elements in a variety of sizes for each increment of permitted pumping capacity will be studied to determine the combination of conveyance and storage which meets the program objectives at the highest and most cost effective level. See the detailed Storage Component description preceding the alternatives.

Given the continued conveyance constraints through the Delta with this alternative, new south of Delta surface storage may not be cost effective due to difficulties in filling and making full use of it. However, new south of Delta surface storage (size to be determined; possibly in the range of 0 - 1.0 MAF) may be useful depending on the degree of water saving that can be achieved with the water use efficiency program. New conjunctive use/groundwater banking (size to be determined; possibly in the range of 0- 600 TAF) may prove to be more cost effective. Upstream storage (size to be determined; possibly in the range of 0 - 1.5 MAF) could be used to manage Delta inflow. In-Delta storage (size to be determined; possibly in the range of 0 - 600 TAF) could provide flexibility for diversions and to enhance environmental flows. More analysis of the benefits, impacts, and technical merits of in-Delta storage will be required during Phase II of the Program.

New storage could enhance existing conveyance

The size, location, and operating criteria for any new surface or groundwater storage will be refined, considering the other components, during studies in the next phase of the Program.

Refine storage size, location, and operations

Operations

The operation of the Delta diversions would remain similar to historical operations. Increasing the permitted capacity of the south Delta pumps would improve operational flexibility by increasing the ability to pump during windows of time which cause the least environmental disruption. Evaluations will be performed by fishery experts to determine the relative importance to the fishery of the various windows of time available for pumping during the year. Pumping operations will be crafted to fit pumping within the windows of least impact to fisheries (e.g., late fall and early winter). Pumping curtailments will be designated for the windows of highest importance to the fishery (e.g., March through June).

Some shift in diversion timing may be possible

Real-time monitoring (although experimental at this time) could be expanded to guide pumping operations, allowing pumping to be curtailed when vulnerable fish are present. This could result in a moderate shift in Delta withdrawals from the March through June period to the fall through mid-winter. Construction of water storage facilities downstream and upstream of the Delta and expanded conjunctive use programs in the San Joaquin Valley and other service areas could greatly increase water management flexibility to convey Delta water to export areas during less environmentally damaging periods, thus avoiding entrainment of vulnerable fish while maintaining the total volume of Delta water use.

Relationship with Other Components

See the descriptions of the four common components (programs) following the alternatives.

Ecosystem Restoration - The implementation of the common program for ecosystem restoration will provide a high level of habitat improvement in the Bay-Delta system. The positioning of new habitat restoration activities would need to consider the continued use of the existing Delta channels and south Delta pumps. New habitat would be located away from the pumps and main conveyance channels to reduce loss of fish.

Avoid new habitat near pumps

Water Quality Improvements - With continued through Delta flow, the current level of water quality for in-Delta uses would be maintained. However, export water quality may be only minimally improved, or even degraded in the absence of remedial measures. Complementary water quality improvements may therefore be desirable. The common water quality program will be crafted to provide the highest achievement of water quality objectives consistent with cost factors considering all beneficial uses. Achieving this high level may require implementing the source control elements of the program near the highest level of the range.

May need additional water quality improvements

System Integrity - While the common program for system integrity will provide a high level of protection for all Delta islands, key islands would need special protection to reduce the vulnerability of water quality for the Delta and Delta exporters. The overall improvements to system integrity will improve flood control in the Delta with special focus on North Delta flood protection needs.

Improve key islands first

Water Use Efficiency - While implementation of the common approach to water use efficiency will substantially reduce the dependence on the Delta for exports, the inherent water diversion limitations with the existing system conveyance will require that water use efficiency measures be pursued at a higher level in this alternative, particularly during drought years (drought fallowing agreements). These conveyance limitations reduce the opportunity to bank water for use during dry periods and the opportunity for water transfers available with other conveyance alternatives.

Need for higher levels of water use efficiency

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of continued use of the Existing System Conveyance with modified export schedule include:

Little disturbance of existing conditions

- Preserves the common Delta pool
- The continued use of the existing conveyance system creates little need for additional institutional assurances
- Less disturbance of habitat in and adjacent to existing channels
- Avoids impacts to in-Delta terrestrial habitats and existing land uses
- May improve operational flexibility for exports

Potential concerns of continued use of the Existing System Conveyance with modified export schedule include:

Little improvements in benefits

- Fish entrainment at the pumps continues
- Export and in-Delta water quality would not improve over existing conditions
- Fish still drawn into areas where they are subject to delay to migration patterns and predation
- South Delta water quality would not improve over existing conditions
- Dredging to support increased pumping can affect aquatic environments
- Real-time monitoring for fisheries management is currently experimental and requires continued evaluation of effectiveness and therefore may not be useful
- Hydrologic and biologic studies are required to identify criteria (quantity and timing windows) for water diversion into storage
- Does not address total salt load in the San Joaquin Valley, resulting in continued high salinity of agricultural return flows to the San Joaquin River

Other considerations include:

- Coordinated CVP/SWP operations could include a "joint point of diversion and use" to allow water pumped by either project to be used by both project users.
- San Joaquin environmental water can be used for pulse flows for fish transport or diluting poor quality flows.

- Investigate the feasibility of wheeling and exchanging water to augment San Joaquin River flows.

- Determine institutional needs to implement long-term drought planning programs.
- Determine institutional requirements for amending California Water Codes to facilitate water transfer procedures.
- Evaluate the use of a Delta central planning institution to manage inflows, transfers, export operations, and outflows.

Potential Sequencing

As the details of the alternatives are refined in Phase II analyses, more detailed phasing concepts will be developed. Phasing offers the opportunity to make the alternatives more affordable by financing costs over a period of time extending 20 to 30 years or more. Future revisions to the plan will acknowledge opportunities for adaptive management. It will also account for the longer planning, permitting, and construction lead times typical for some portions of the alternatives. The following is intended solely to demonstrate the phasing concept:

Begin with portions of common programs

Phase 1. Implementation would begin with the early portions of the common programs (water use efficiency, water quality improvements, system integrity, and ecosystem restoration) that qualify for early implementation. Begin planning and permitting long lead time features for storage and conveyance components.

Most beneficial portions of common programs

Phase 2. Actions implemented during Phase 2 of this alternative would include modest levels of the four common programs (water use efficiency, water quality improvements, system integrity, and ecosystem restoration). Since these are programs that will be funded over many years, they will be prioritized so actions yielding the highest benefit are implemented early. Dredging to maintain channels would be included in Phase 2.

Higher levels of common programs

Phase 3. The third phase would include moderate levels of the four common programs based on prioritization of benefits. This phase would also include selective channel improvements (if included) with corresponding increases in permitted pumping capacity. Storage (if included) would be constructed.

Highest levels of common programs

Phase 4. The fourth phase will include the most aggressive levels of the four common programs based on prioritization of benefits.

Alternative 2

Conveyance Variable:	**Modified Through Delta Conveyance**
Storage Variable:	**Upstream-, South- and/or in-Delta storage** **Conjunctive use/Groundwater Banking** (may include a range between no storage or any combination of these)
Common Programs:	**Water Use Efficiency** **Water Quality** **Levee System Integrity** **Ecosystem Restoration**

Conveyance Variable

Improved conveyance across Delta from north to south

This alternative is formed around physical modification of Delta channels to support continued conveyance through the Delta from north to south. A new screened or unscreened diversion from the Sacramento River along with channel modifications will increase flow capacity and decrease flow velocity. The diversion will be studied for the general reach between Georgiana Slough and Hood. Channels could be widened and/or deepened to improve flow conditions (size to be determined).

Incorporate habitat

The channel improvements could be designed to provide corridors of habitat along selected channels. Studies will be made to determine the placement of habitat corridors and whether they should be included along channels intended for conveyance. Setback levees could provide restored shaded riverine aquatic habitat, shallow water habitat, as well as increased water conveyance and flood protection.

Optional conveyance configurations could include extensive land conversion to habitat uses

The magnitude of the improvements will be studied during Phase II but may vary from selective channel improvements that reduce hydraulic constraints, to extensive reconfiguration with wide habitat and flow corridors. The size and configuration of the channel improvements will be determined by biological and hydrologic studies, considering the other components of the program. The width of setbacks needed to provide optimum benefits for ecosystem quality and water supply still needs to be determined. If standard setbacks are inadequate, the conversion of islands into tidally influenced habitat will be studied to determine its technical feasibility and cost effectiveness.

Setback levees might reduce the impact of the south Delta diversions on fish populations by reducing channel velocities toward those diversions and providing attractive habitat for fish. The potential for continued entrainment will be studied in the next phase of the Program. A full range of through Delta conveyance options will be studied, including both screened and unscreened diversions from the Sacramento River near Hood, near Locke, through Andrus Island, and from the San Joaquin River near its confluence with Old and Middle Rivers. The studies will include evaluation of potential reductions in carriage water (additional flows released during export periods to ensure maintenance of water quality standards and assist with maintaining natural outflow patterns in Delta channels) during dry and critical years.

Refine with studies

Storage Variable

Studies during the next phase of the Program will determine what storage, if any, could be beneficial to the alternative when teamed with the conveyance and common programs. Combinations of storage elements in a variety of sizes for each increment of through Delta conveyance improvement will be studied to determine the combination of conveyance and storage which meets the program objectives at the highest and most cost effective level. See the detailed Storage Component description preceding the alternatives.

Study combinations of storage and conveyance

New south of Delta surface storage (size to be determined; possibly in the range of 0 - 1.5 MAF) may be useful in modifying timing of Delta diversions. New conjunctive use/groundwater banking (size to be determined; possibly in the range of 0- 500 TAF) could work well to enhance the effectiveness of the water use efficiency program. Upstream storage (size to be determined; possibly in the range of 0 - 1.5 MAF) could be used to manage Delta inflow. In-Delta storage (size to be determined; possibly in the range of 0 - 600 TAF) could provide flexibility for diversions and enhance environmental flows. More analysis of the benefits and impacts of in-Delta storage is needed.

New storage could enhance through Delta conveyance

The size, location, and operating criteria for any new surface or groundwater storage will be refined, considering the other components, during studies in the next phase of the Program.

Refine storage size, location, and operations

Operations

The permitted capacity of existing export pumps could be expanded to their full physical capacity, but only during windows when fish are less vulnerable. Evaluations will be performed by fishery experts to determine the relative importance to the fishery of the various windows of time available for pumping during the year. Pumping operations will be crafted to fit pumping within the windows of least impact to fisheries (e.g., late fall and early winter). Pumping curtailments will be designated for the windows of highest importance to the fishery (e.g., March through June). Real-time monitoring (although experimental at this time) could be expanded to guide pumping operations, allowing pumping to be curtailed when vulnerable fish are present. This could result in a moderate shift in Delta withdrawals from the March through June period to the fall through mid-winter. Construction of water storage facilities downstream and upstream of the Delta and expanded conjunctive use programs in the San Joaquin Valley and other service areas could greatly increase water management flexibility to convey Delta water to export areas during less environmentally damaging periods (e.g., late fall and early winter), thus avoiding entrainment of vulnerable fish while maintaining the total volume of Delta water use.

Moderately shift Delta withdrawals to the fall through mid-winter

Diverting water from the Sacramento River and conveying it through the Delta would require development of new standards to ensure continued protection of the Bay-Delta ecosystem. The existing standards related to export ratios and salinity, and requirements for carriage water, will need to be re-evaluated with the development of these new facilities to ensure a necessary level of protections for the ecosystem.

Withdrawals from the Delta would continue to rely on existing facilities (with potential modifications of existing screening facilities and/or new screens on the Sacramento River). As described above, Delta withdrawals could be shifted away from the March through June period to the extent possible by using existing storage and new storage (if any) downstream of the Delta. The shift in Delta withdrawal timing would reduce impacts associated with Delta exports. Improved channel capacities in the north and south Delta would improve efficient water movement across the Delta.

Continue exports from south Delta

Average and Wetter Year Operation

- Upstream storage could be filled during the receding limb of peak flood hydrographs and released as needed to meet downstream needs. South of Delta storage could be filled with withdrawals from the Delta during the receding limb of peak flood hydrographs. Water stored in this manner could offset pumping during the spring and summer period to reduce Delta withdrawals and impacts to Delta fisheries.

- Using timing shifts allowed by meeting consumptive demand from south of Delta storage, Delta withdrawals could be moderately reduced in the March through June period. During average and wetter water years the reduced withdrawals may result in increased Delta outflow by a similar amount during the March through June period.

Dry and Critical Year Operation

- Conjunctive use programs, groundwater banking, and drought year land conversion agreements developed in the San Joaquin Valley could be used to offset Delta withdrawals for export and increase Delta outflow in the March through June period.

Relationship with Other Components

See the descriptions of the four common components (programs) following the alternatives.

Ecosystem restoration coordinated with other improvements

Ecosystem Restoration - The implementation of the common program for ecosystem restoration will provide a high level of habitat improvement in the Bay-Delta system. Setback levees, island flooding, and large conveyance corridors can be physically configured to implement desired ecosystem restoration strategies. For example, a setback levee could be constructed with a vegetated water side slope and a gradually sloping water side bench to create shallow riverine, riparian and upland habitats.

Water quality improvements

Water Quality Improvements - With continued through Delta flow, the current level of water quality for in-Delta uses would be maintained or improved. However, export water quality may be only minimally improved, or even degraded in the absence of remedial measures. Complementary water quality improvements may therefore be desirable. The common water quality program will be crafted to provide the highest achievement of water quality objectives consistent with cost factors considering all beneficial uses. Achieving this high level may require implementing the source control elements of the program near the highest level of the range.

System integrity coordinated with other

System Integrity - While the common program for system integrity will provide a high level of protection for all Delta islands, key islands would need special protection to reduce the vulnerability of water quality and conveyance for the Delta and Delta exporters. The overall improvements to system integrity will improve flood control in the Delta with special focus on North Delta flood protection needs.

improvements

Water Use Efficiency - Water use efficiency programs will be developed to complement the storage and conveyance components of the alternative. Implementation of the common water use efficiency program will substantially reduce the dependence on the Delta for exports. The through Delta improvements should improve the opportunities to transfer conserved water to environmental and supply uses.

Water use efficiency improved

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of Through Delta Conveyance include:

- Improved operational flexibility such as ability to shift timing of diversions to protect fisheries, increase supply opportunities, transfers, and wet year diversions
- Preserves the common Delta pool
- May reduce entrainment effects of existing export facilities on fish
- Improves fishery habitat
- May improve export water quality, especially at certain times of the year
- May improve in-Delta water quality
- May reduce carriage water losses in critical years thereby benefitting water supply
- Creates a more efficient method of transferring water to export pumps.

Preserves common Delta pool while reducing conflicts

Potential concerns of Through Delta Conveyance include:

- Habitat corridors combined with conveyance channels may adversely impact fish entrainment
- Real-time monitoring for fisheries management is currently experimental and requires continued evaluation of effectiveness and therefore may not be useful
- Hydrologic and biologic studies are required to identify criteria (quantity and timing windows) for water diversion into storage
- Depending on the type of improvements chosen, a through Delta facility may have temporary construction impacts on

Many studies

aquatic environments due to dredging | *required*

- Setback levees may have long-term impacts on terrestrial habitats and on agricultural land uses
- Screened diversion on the Sacramento could expose a higher number of migrating salmon to screening impacts
- Diversion on the Sacramento River downstream of the City of Sacramento would be within native fish critical habitat
- Screened diversions on the Sacramento River may be subject to periodic shutdowns when critical fish populations are determined to be present in the area of the screens
- There are significant technical challenges to overcome in designing an efficient screening system for diversions over 3,000 cfs
- Total Delta outflow may be reduced, though outflow during important periods is increased
- Implementing a through Delta facility, which utilizes very wide channels and low velocities may require large conversions of agriculture land to aquatic environments
- May only partially address total salt load in the San Joaquin Valley, resulting in continued high salinity of agricultural return flows to the San Joaquin River

Other considerations include:

- Coordinated CVP/SWP operations could include a "joint point of diversion and use" to allow water pumped by either project to be used by both project users.
- Increased pumping capacity at CVP/SWP south Delta facilities will be guided by real-time monitoring programs.
- San Joaquin environmental water can be used for pulse flows for fish transport or diluting poor quality flows.
- Investigate the feasibility of wheeling and exchanging water to augment Jan Joaquin River flows.
- Determine institutional needs to implement long-term drought planning programs.
- Determine institutional requirements for amending California Water Codes to facilitate water transfer procedures.
- Evaluate the use of a Delta central planning institution to manage inflows, transfers, export operations, and outflows.
- An alternative formulation consisting of a screened diversion near Andrus Island and crossing the island to Georgiana Slough, then across Tyler Island to the Mokelumne River will be investigated. This information would include pumped releases at Georgiana Slough that would establish a hydraulic barrier to fish migration.

Potential Sequencing

As the details of the alternatives are refined in Phase II analyses, more detailed phasing concepts will be developed. Phasing offers the opportunity to make the alternatives more affordable by financing costs over a period of time extending 20 to 30 years or more. Future revisions to the plan will acknowledge opportunities for adaptive management. It will also account for the longer planning, permitting, and construction lead times typical for some portions of the alternatives. The following is intended solely to demonstrate the phasing concept:

Begin with portions of common programs

Phase 1. Implementation would begin with the early portions of the common programs (water use efficiency, water quality improvements, system integrity, and ecosystem restoration) that qualify for early implementation. Begin planning and permitting long lead time features for storage and conveyance components.

Most beneficial portions of common programs

Phase 2. The second phase of implementing this alternative will begin channel improvements and provide modest levels of the four common programs (water use efficiency, water quality improvements, system integrity, and ecosystem restoration). Since these are programs that will be funded over many years, they will be prioritized so actions yielding the highest benefit are implemented early.

Higher levels of common programs

Phase 3. The third phase will include additional channel improvements and moderate levels of the four common programs based on prioritization of benefits. This phase would also include the diversion screen (if included) and channel improvements with corresponding increases in permitted pumping capacity. Storage (if included) would be constructed.

Highest levels of common programs

Phase 4. This phase will complete the channel improvements and include the most aggressive levels of the four common programs based on cost-effectiveness.

Alternative 3

Conveyance Variable:	**Dual Conveyance**
Storage Variable:	**Upstream-, South- and/or in-Delta storage** **Conjunctive use/Groundwater Banking** (may include a range between no storage or any combination of these)
Common Programs:	**Water Use Efficiency** **Water Quality** **Levee System Integrity** **Ecosystem Restoration**

Conveyance Variable

New conveyance improves reliability, flow conditions, water quality

This Dual Delta Conveyance alternative is formed around a combination of improved though Delta conveyance and new isolated conveyance. It could include a new screened diversion facility on the Sacramento River between Hood and Freeport. This diversion facility could supply a new isolated conveyance facility to transport water around the east side of the Delta to the existing south Delta pumping plants. The new screened diversion facility may also supply water for continued through-Delta conveyance.

Dual diversion and isolated conveyance protect water quality and fish

The new dual diversion facility on the Sacramento River could be equipped with state-of-the-art fish screens to minimize entrainment of fish. During Phase II, real-time monitoring (consistent with its experimental status at this time) will be evaluated to determine its capacity to shift diversions among multiple intakes and avoid entrainment effects during critical periods. A new canal, isolated from Delta channels, to convey water from the new diversion point to the existing Banks and Tracy Pumping Plants will be evaluated along with a combination of storage elements. For some of the smaller isolated conveyance capacities, a buried pipeline concept will be evaluated. In addition, a fully isolated conveyance with sufficient capacity to meet the full physical capacity of the State and Federal Projects will be evaluated.

Potential to enhance Delta tributary flows

The isolated facility could be sized to supply most Delta export needs during sensitive spring periods and potentially to provide drinking water supplies to some users in Sacramento County, San Joaquin County, and the Bay Area through spur lines. The isolated conveyance facility includes siphons under all important stream courses to prevent disruption of water quality and aquatic habitat values in the streams. Direct connections to water districts served by spur lines could provide opportunities to offset releases from San Joaquin River tributary reservoirs for environmental purposes.

Evaluate a full range of isolated and through Delta improvements

The isolated conveyance can be sized and operated to convey from 5,000 to 15,000 cfs to the south Delta export facilities. The combined diversion capacity of the State and Federal projects is limited to approximately 15,000, the physical capacity of the downstream conveyance system. While the combined capacities of the through Delta channels and the isolated conveyance could be larger, the downstream conveyance capacity will not be increased. The largest isolated conveyance to be evaluated will deliver no more than 15,000 cfs to the sough Delta export facilities. A variety of through Delta conveyance capacity sizes will be evaluated with this facility to increase operational flexibility. Depending on the needs at specific times and the operational parameters for fishery protection, only the isolated conveyance may operate, only the through Delta conveyance may operate, or some combination of the two may operate. In addition to this Dual Delta conveyance operation, a fully isolated conveyance will be evaluated. In this case, all exports would pass through the isolated facility with no through Delta conveyance to the export facilities.

Some through-Delta conveyance continues

The through Delta conveyance capacity could range from use of the existing unaltered channels to channel enlargements by dredging and setback levees. However, since the through Delta conveyance will operate in conjunction with the isolated conveyance, the through Delta channel modifications are not likely to be as extensive as in Alternative 2. For example, selective improvements to north and south Delta channels may be adequate when combined with higher capacities of isolated conveyance. Improvements to north Delta channels could be designed to provide multiple benefits for flood conveyance, habitat restoration, water supply, and south Delta water quality. A variety of actions and operational scenarios will be studied and implemented to address potential adverse effects of salinity in San Joaquin River inflow, to maintain water levels and circulation in south Delta channels, and to reduce recycled salt load to the San Joaquin Valley.

Optional diversion points

A range of diversion points from Hood through Freeport are possible on the Sacramento River below the confluence with the American River. One variation that can be investigated is a screened diversion point upstream of Bryte that utilizes either the Yolo Bypass or the Sacramento

Ship Channel to convey water south to Liberty Island and then crosses Ryer and Grand Islands, siphons under the Sacramento River, and rejoins the previously discussed eastern canal alignment. A further variation could include an extension to tie this facility to the Tehema Colusa Canal.

Optional conveyance configurations

Other configurations could include alternate conveyance routings such as the isolated conveyance constructed as a series of flooded islands connected by siphons. The configuration and relative sizes of the isolated and through Delta conveyances will be refined, considering the other components, during the studies in the next phase of the Program. A full range of isolated conveyance capacities and through Delta conveyance options, will be considered.

Storage Variable

Study combinations of storage and conveyance

Studies during the next phase of the Program will determine what storage, if any, could be beneficial to the alternative when teamed with the conveyance and common programs. Combinations of storage elements in a variety of sizes for each through Delta/isolated conveyance will be studied to determine the combination of conveyance and storage which meets the program objectives at the highest and most cost effective level. See the detailed Storage Component description preceding the alternatives.

New storage could enhance Dual Delta conveyance

New south of Delta surface storage (size to be determined; possibly in the range of 0 - 1.5 MAF) may be useful in changing timing of Delta diversions. New conjunctive use/groundwater banking (size to be determined; possibly in the range of 0- 500 TAF) could work well to enhance the effectiveness of the water use efficiency program. Upstream storage (size to be determined; possibly in the range of 0 - 3.0 MAF) could be used to manage Delta inflow and to manage instream flows and diversions in the Sacramento River. The storage could be filled using the excess capacity in the Tehama Colusa Canal and the Glenn Colusa Canal. The reservoir(s) could be used to serve the irrigation districts served by these canals to curtail diversions out of the river during more environmentally sensitive periods. The Tehama Colusa Canal could also be extended to serve the North Bay aqueduct and eliminate that Delta diversion. Future extensions of the canal possibly include a direct connection to the isolated facility. In-Delta storage (size to be determined; possibly in the range of 0 - 600 TAF) could provide flexibility for diversions and to enhance environmental flows. More analysis of the benefits and impacts of in-Delta storage is needed.

The size, location, and operating criteria for any new surface or groundwater storage will be refined, considering the other components, during studies in the next phase of the Program.

Refine storage size, location, and operations

Operations

The dual conveyance will normally operate with some through Delta portion to maintain water circulation in the central and south Delta during critical periods for stage and water quality. Remaining Delta diversions could be carried, depending on conveyance size, by the isolated conveyance.

Moderately shift Delta withdrawals to the fall through mid-winter

The permitted capacity of existing export pumps could be expanded to their full physical capacity, but only during windows when fish are less vulnerable. Evaluations will be performed by fishery experts to determine the relative importance to the fishery of the various windows of time available for pumping during the year. Pumping operations will be crafted to fit pumping within the windows of least impact to fisheries. Pumping curtailments will be designated for the windows of highest importance to the fishery (e.g., March through June). Real-time monitoring could be expanded to guide pumping operations, allowing pumping to be curtailed when vulnerable fish are present. This could result in a moderate shift in Delta withdrawals from the March through June period. Construction of water storage facilities downstream and upstream of the Delta and expanded conjunctive use programs in the San Joaquin Valley and other service areas will greatly increase water management flexibility to convey Delta water during less environmentally damaging periods, thus avoiding entrainment of vulnerable fish while maintaining the total volume of Delta water use.

The configuration of dual Delta conveyance may offer a significant increase in flexibility to divert water while protecting fish from entrainment. With two distinct diversion points, one on the Sacramento River and another in the south Delta, operations can be designed to emphasize use of different diversions at different times according to the presence of vulnerable species near the diversion points.

Diverting water from the Sacramento River into the Delta and isolated facility would require development of new standards to ensure continued protection of the Bay-Delta ecosystem. The existing standards related to export ratios and salinity, and requiremenets for carriage water, will need to be re-evaluated with the development of these new facilities to protect the ecosystem from impacts of exporting water to the south of the Delta.

Re-evaluate standards for protection of Bay-Delta ecosystem

Average and Wetter Year Operation

- The flow through the isolated conveyance will be the increment above that needed to maintain Delta channel stage and water quality. Delta export withdrawals greater than the capacity of the isolated conveyance facility could be conveyed through the improved Delta channels.
- Water transfers could be conveyed through the isolated facility during periods of available capacity and through the Delta. Transfers made in average and wetter years would be stored in either surface or groundwater facilities or made available to end users to meet consumptive demands.

Dry and Critical Year Operation

- A greater portion of the Delta export could be conveyed through the isolated facility to reduce, to the maximum extent possible, impacts to Delta fisheries while balancing needs for Delta channel stage and water quality.
- Conjunctive use programs and groundwater banking developed in the San Joaquin Valley could be used to reduced exports in the spring and summer.
- Opportunities will increase for transferring water through the isolated facility which would be used to satisfy unmet consumptive use demands.

Relationship with Other Components

See the descriptions of the four common components (programs) following the alternatives.

Water quality improvements

Water Quality Improvements -Water Quality for exports could be improved depending on the size of the isolated facility. If the isolated facility was sized similar to the full south Delta pumping capacity, the water quality of exports would be similar to the Sacramento River at the diversion. The export water quality would be a blend of Sacramento River and south Delta water but the water quality of exports would improve over existing conditions. Isolated conveyance operations would reduce the flow of relatively high quality water from the Sacramento River into the central and south Delta. With continued through Delta flow, adequate water quality for in-Delta uses would be maintained. Water quality and stage could be reduced at critical times, adversely affecting Delta water users. Purchase of water on the San Joaquin River system, in-Delta storage, and measures to control stage and quality in the south Delta could offset these effects. A program will be developed to provide the highest water quality considering all beneficial uses.

Ecosystem Restoration -A major benefit would be achieved by relocating the export diversion from the current south Delta location and adding a state-of-the-art screening facility(s) to reduce diversion effects on fish. The dual conveyance offers increased flexibility to improve fishery benefits, especially if both diversions are screened. For the through Delta modifications setback levees, island flooding, and large conveyance corridors can be physically configured to implement desired ecosystem restoration strategies. For example, existing islands can be reshaped or a setback levee could be constructed with a vegetated water side slope and a gradually sloping water side bench to create shallow riverine, riparian and upland habitats.

Ecosystem restoration coordinated with other improvements

System Integrity -The probability of a complete prolonged shutdown of the water projects and local diversions will be greatly reduced with dual conveyance. While the common program for system integrity will provide a high level of protection for all Delta islands, key and/or remaining islands would need special protection to reduce the vulnerability of water quality and conveyance for the Delta and Delta export. The overall improvements to system integrity will improve flood control in the Delta.

System integrity coordinated with other improvements

Water Use Efficiency - Implementation of the common water use efficiency program will substantially reduce the dependence on the Delta for exports. An isolated facility and Delta channel improvements would increase the flexibility to use the conserved water for environmental and supply purposes. There would be greater opportunity to bank water for use during dry periods and greater opportunities to utilize water transfers.

Water use efficiency improved

Potential Benefits and Concerns that Need to be Addressed in Phase II

Potential benefits of the Dual Delta Conveyance include:

- Improved operational flexibility such as ability to increase supply opportunities, transfers, and wet year diversions
- Preserves some continued diversion from the common Delta pool
- More flexibility to increase supply while avoiding fishery impacts
- Can improve export water quality, especially at certain critical times of the year
- Can supply water to Bay Area and east of Delta water users, providing opportunities for restoring flows in Delta tributaries

Improved system flexibility

- Reducing the amount of export pumping in the south Delta in combination with moving the diversion point for the balance of exports will reduce entrainment of fish during more vulnerable periods.
- May reduce carriage water losses in critical years thereby benefitting water supply
- May significantly reduce total salt load in the San Joaquin Valley, improving the quality of agricultural return flows to the San Joaquin River

Potential concerns of the Dual Delta Conveyance include:

Need to evaluate potential adverse effects

- Real-time monitoring for fisheries management is currently experimental and requires continued evaluation of effectiveness
- Hydrologic and biologic studies are required to identify criteria (quantity and timing windows) for water diversion into storage
- Could affect central and south Delta water quality
- Channel widening may require agricultural land conversion
- Construction of isolated conveyance facility affects wetland and terrestrial habitats and land uses
- Screened diversion on the Sacramento could expose a higher number of migrating salmon to screening impacts
- Diversion on the Sacramento River downstream of the City of Sacramento would be within native fish critical habitat
- Screened diversions on the Sacramento River may be subject to periodic shutdowns when critical fish populations are determined to be present in the area of the screens
- There are significant technical challenges to overcome in designing an efficient screening system for diversions over 3,000 cfs.
- Total Delta outflow may be reduced

Other considerations include:

- Coordinated CVP/SWP operations could include a "joint point of diversion and use" to allow water pumped by either project to be used by both project users.
- San Joaquin environmental water can be used for pulse flows for fish transport or diluting poor quality flows.
- Investigate the feasibility of wheeling and exchanging water to augment Jan Joaquin River flows.
- Determine institutional needs to implement long-term drought planning programs.
- Determine institutional requirements for amending California

Water Codes to facilitate water transfer procedures.
- Evaluate the use of a Delta central planning institution to manage inflows, transfers, export operations, and outflows.

- Diversion would be constructed at a location upstream of the Delta such as Hood or Freeport and sited to minimize intrusion into native fish habitat.
- Use best available screening technology on multiple intakes and real-time monitoring to minimize fisheries impacts.
- Siphons will carry isolated conveyance facilities beneath existing Delta channels to minimize environmental, water quality, and flood conveyance impacts.
- The feasibility of using a buried aqueduct and multiple intakes needs to be investigated.
- A variation of this alternative will be investigated that would divert water upstream of Bryte and use the Yolo Bypass or the Sacramento Ship Channel for conveyance to the planned isolated facility near Hood or Freeport.
- Potential to exchange water to increase San Joaquin River flows needs to be investigated.
- East-side channel flood control improvements could be investigated, particularly on the lower reaches of the Mokelumne River.

Need to evaluate many other considerations

Potential Sequencing

As the details of the alternatives are refined in Phase II analyses, more detailed phasing concepts will be developed. Phasing offers the opportunity to make the alternatives more affordable by financing costs over a period of time extending 20 to 30 years or more. Future revisions to the plan will acknowledge opportunities for adaptive management. It will also account for the longer planning, permitting, and construction lead times typical for some portions of the alternatives. The following is intended solely to demonstrate the phasing concept:

Phase 1. Implementation would begin with the early portions of the common programs (water use efficiency, water quality improvements, system integrity, and ecosystem restoration) that qualify for early implementation. Begin planning and permitting long lead time features for storage and conveyance components.

Begin with portions of common programs

Phase 2. Actions implemented during Phase 2 of this alternative will include modest levels of the four common programs (water use efficiency, water quality improvements, system integrity, and ecosystem restoration). Since these are programs that will be funded over many years, they will be prioritized so actions yielding the highest benefit are implemented early.

Most beneficial portions of common programs

Phase 3. Phase 3 will consist of constructing the dual diversion facilities on the Sacramento River in the north Delta, the isolated conveyance facility for a portion of Delta exports, and north Delta channel improvements. Moderate levels of the four common programs will be implemented based on prioritization of benefits.

Higher levels of common programs

Phase 4. In Phase 4 downstream water storage (if included) will be constructed to increase capabilities to coordinate Delta water use and shifted upstream reservoir storage operations. Storage upstream of the Delta (if included) will be constructed to maximize flexibility in managing flows through the Delta. The most aggressive levels of the four common programs will be implemented based on prioritization of benefits.

Highest levels of common programs

Cost Considerations

FINANCIAL STRATEGY

One of the unique aspects of the CALFED Bay-Delta Program is that a strategy for funding the long-term solution is being developed as an integral part of the overall program. This concept relates to the Program's Solution Principle concerning implementability, which requires that the preferred alternative be practical and feasible. The best alternative for the Bay-Delta is of limited value if it cannot be implemented due to lack of funding.

During Phase I, developing the financial strategy has required 1) working toward an understanding of the basic policy issues and options related to development of the plan of finance, 2) defining possible funding mechanisms including near term funding for early implementation activities, and 3) working with stakeholder groups to understand the costs of the alternatives and the implications for use of financial techniques to make those costs more affordable. Costs for the alternatives in Phase I have been described in terms of approximated ranges, so no specific dollar amounts have been identified for any particular program or stakeholder group.

What has emerged is an indication of some characteristics of a successful long-term plan of finance. For example, the cost of the long-term solution needs to be shared by many sectors of society. No single sector or revenue source will shoulder the burden for the long term solution. Another important factor is that the costs of the alternative will be phased in over an extended period of time. This will help soften the financial impact on affected parties, contributing to the affordability of the long-term solution.

SOME CHARACTERISTICS OF A SUCCESSFUL LONG-TERM PLAN OF FINANCE

- Costs shared by many sectors of society
- Costs phased over an extended period of time

Two draft reports relating to financial strategy were issued as part of Phase I. The first report, issued in October 1995, described a wide range of revenue sources and financing techniques which might be available as part of a long-term plan of finance. This report was issued in part as a response to concerns that the program examine many different funding sources, as opposed to concentrating on a few traditional funding methods which might tend to concentrate the financial burden on a few sectors of society.

Focus then shifted to how the costs of the program might be allocated among these many sources. Conventional cost allocation approaches for multi-purpose projects do not necessarily work well for programs like CALFED which have an emphasis on ecosystem restoration. The second draft report, issued in January 1996, began to address this cost allocation issue.

A special fact finding group was formed under the auspices of the Bay Delta Advisory Council to review the overall financial strategy from a policy perspective, and make suggestions for modifications which may improve acceptance of the eventual strategy. Financial strategy discussions which began in Phase I will continue into Phase II.

By the end of Phase II, the plan of finance should identify the types of revenues the long-term solution will require, the timing of the need for these funds, and the means by which these revenues will be raised. Detailed cost estimates will not be identified until project-specific EIS/EIR work in Phase III when exact sites and other specifics are known.

To complete Phase II, there are a number of intermediate steps which must be taken relating to identification of program funding participants, defining types of costs which will be incurred, timing of the costs, how the necessary revenues will be raised, and how the costs will be allocated. In addition, the rough cost estimates provided in Phase I will be refined in order to provide a better indication of the timing of construction expenditures and more precision regarding the amount of funding required.

ESTIMATED COST RANGE

The capital costs for the ten alternatives, identified in the *Phase I Progress Report*, were estimated to generally fall in the range from $4 billion to $8 billion, with the most expensive alternative exceeding $12 billion. While it is anticipated that the total cost of the three Phase II alternatives will fall within this cost range, the current component structure of the three Phase II alternatives, with common programs implemented over 20 to 30 years, requires that cost be viewed from a different perspective. For example, the range of costs of the Phase II Alternative common program elements can be generally characterized as:

- Levee System Integrity - $1 to $1.5 billion over 20 to 30 years
- Water Quality - $0.5 to $1 billion over 10 to 30 years
- Water Use Efficiency - $0.5 to $1 billion over 10 to 30 years
- Ecosystem Restoration - $1 to $2 billion over 20 to 30 years

The storage and conveyance components, which provide multiple benefits, are estimated to cost in the range of $ 1.5 to $3 billion. While construction expenditures for these components are likely to be concentrated in just a few years, the actual cost impact would likely be spread over 30 or more years through the use of bond financing. Cost estimates for each component will be refined during Phase II analyses.

Some of the common program costs will be absorbed by existing programs. For example, several habitat and fishery related actions are already included and funded under existing programs such as the Central Valley Project Improvement Act. A portion of the levee system integrity elements are funded under State programs and many water use efficiency elements are currently funded by water purveyors. Furthermore, under the Program's "affordability" solution principle, the solution alternative ultimately selected must be one that can be implemented and maintained using foreseeable resources. As a result, if analysis indicates that adequate funds cannot be anticipated to support a particular alternative, that alternative will be changed or discarded. Because the Program has multiple objectives, the cost of the ultimate solution will support and be spread over many distinct and complex projects—possibly including hundreds of acres of new habitat, miles of rebuilt levees, and storage facilities ranging from 100,000 to millions of acre feet, for example. Each of these actions is a massive undertaking; even creation of new habitat carries a high price tag, requiring that many tons of earth be moved and many acres of landscape changed. In addition, just as these projects will be completed successively, the financing can be structured in increments. Even the highest cost estimate seems less daunting when spread over a quarter or a third of a century.

Neither one sector of society nor one revenue source will shoulder responsibility for paying for the ultimate solution alternative. Rather, many entities—ranging potentially from government agencies to water users—will share the cost; and the funding strategy will include several revenue streams, possibly including federal grants, private-public partnerships, and general obligation bonds.

Next Steps

During Phase I, the Program Team, in concert with CALFED agencies, the Bay-Delta Advisory Council, stakeholders and the general public, agreed on the fundamental problems in the Bay-Delta system and defined mission, goals, objectives and solution principles. Together, these items along with comments received during the environmental impact report/statement (EIR/EIS) Scoping process guided the identification of alternatives which are being carried into Phase II for further refinement and evaluation.

Three concurrent efforts will be undertaken in Phase II. These include:

- refinement of the components and actions making up the Phase II alternatives
- development of strategies for implementing the alternatives
- implementation of a broad environmental review to identify the impacts of the various alternatives

There will be extensive interaction among these three efforts throughout Phase II.

COMPONENT REFINEMENT

Additional refinement of the four common programs and the two variable components in each alternative is required to narrow the range of each. Refinement of all the components will continue through Phase II and will include:

- technical studies of both an environmental and engineering nature; for example, fish entrainment and fish passage studies
- land use analysis and preliminary design; preliminary evaluations to determine the feasibility of sites for locating the various action items such as existing site geology, information on general seepage characteristics and seismic risk information
- development of general operating requirements through hydrologic and hydraulic modeling
- refinement of the capacities or dimensions of components and common programs
- development of preliminary cost estimates for the components and common programs
- determination of components and common programs cost effectiveness

Financing and institutional/assurances components will be developed to complement the conveyance, storage and four common programs contained in each alternative. The financing and institutional/assurances provide the path towards the necessary financing to implement the alternative and the assurances that the program will be implemented and operated as intended.

IMPLEMENTATION STRATEGIES

Implementation strategies will be developed in Phase II to set the alternatives in motion. It is expected that these strategies will vary for different components of an alternative. These will address technical, financial, institutional and organizational decisions necessary to start the actions at the beginning of Phase III. These may be based on existing methods or rely on new approaches. The BDAC has set up workgroups to examine policy issues, including implementation strategies, related to water use efficiency, financing, assurances or guarantees and ecosystem restoration and is expected to set up additional groups covering other components.

ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT

The full environmental implications associated with each alternative will bedeveloped during Phase II and documented in a programmatic environmental impact report/statement (EIR/EIS). The primary purpose of the document will be to inform decision makers about the interrelated and cumulative environmental consequences of the alternatives and to identify a preferred program alternative for implementation. The effort will conclude with Certification of the EIR/EIS, an explanation (Record of Decision) as to why a particular course of action was selected and a written statement (Findings) explaining how each significant impact and alternative were dealt with in the EIR/EIS.

Opportunities for agency, stakeholder and public interaction will come during the impact assessment process, following release of the draft and final EIR/EIS, during the development of the Record of Decision and Findings of Fact and in the preparation of an environmental commitment plan/mitigation monitoring program.

The EIS/EIR will concentrate on the foreseeable impacts, direct, indirect and cumulative. Analytical tools will be used in the EIR/EIS to compare and display the range of impacts associated with the various alternatives.

Several ongoing programs and projects may have some features overlapping with the Phase II alternatives. During Phase II, the Program team will evaluate these overlaps and policy issues related to these programs/projects and identify how they can best fit with the Bay-Delta Program. Specifically, the San Joaquin Drainage Program will be described. However, the Program will not develop an independent plan or program to deal directly with the San Joaquin valley drainage issue, but will take a drainage management approach as it relates to water quality in the San Joaquin River. CVPIA is an example of a program that needs to be closely coordinated with the CALFED Bay-Delta Program due to the numerous fishery and habitat enhancement actions in each program.

Glossary of Terms

AF Abbreviation for acre feet; the volume of water that would cover one acre to a depth of one foot, or 325,851 gallons of water. On average, could supply 1-2 households with water for a year.

Alternative A collection of actions or action categories assembled to provide a comprehensive solution to problems in the Bay-Delta system.

Action A structure, operating criteria, program, regulation, policy, or restoration activity that is intended to address a problem or resolve a conflict in the Bay-Delta system.

Action Category A set of similar actions. For example, all new or expanded off-stream storage might be placed into a single action category.

Anadromous Fish Fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

Best Management Practices (BMP) An urban water conservation measure that the California Urban Water Conservation Council agrees to implement among member agencies. The term is also used in reference to water quality standards.

Carriage Water Additional flows released during export periods to ensure maintenance of water quality standards and assist with maintaining natural outflow patterns in Delta channels. For instance, a portion of transfer water released from upstream of the Delta intended for export from south Delta would be used for Delta outflow.

Central Valley Project (CVP) Federally operated water management and conveyance system that provides water to agricultural, urban, and industrial users in California.

Central Valley Project Improvement Act **(CVPIA)** This federal legislation, signed into law on October 30, 1992, mandates major changes in the management of the federal Central Valley Project. The CVPIA puts fish and wildlife on an equal footing with agricultural, municipal, industrial, and hydropower users.

CFS An abbreviation for cubic feet per second.

Channel Islands Natural, unleveed land masses within Delta channels. Typically good sources of habitat.

Common Delta Pool This concept suggests the Delta provides a common resource, including fresh water supply for all Delta water users, and all those whose actions have an impact on the Delta environment share in the obligation to restore, maintain and protect Delta resources, including water supplies, water quality, and natural habitat.

Common Program Four programs for Water Use Efficiency, Water Quality, Levee System Integrity, and Ecosystem Restoration that are essentially the same for each of the three Phase II alternatives.

Component A group of related action categories; the largest building blocks of an alternative. The components for the Phase II Alternatives include a component for Delta conveyance, a component for storage, and the four common programs.

Conjunctive Use The operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the ground water basin for later use in place of or to supplement surface supplies. Water is stored by intentionally recharging the basin during years of above-average water supply.

Conveyance A pipeline, canal, natural channel or other similar facility that transports water from one location to another.

Core Actions Actions that would be included in all CALFED Bay-Delta Program alternatives. Core actions are no longer viewed as a single set of actions. Rather, these actions are now distributed between the four common programs included in each of the three Phase II Alternatives. These actions basically serve the same role as when originally formulated but are now viewed as the first phase of implementation within each of the four common programs.

Delta Islands Islands in the Sacramento-San Joaquin Delta protected by levees. Delta Islands provide space for numerous functions including agriculture, communities, and important infrastructure such as power plants, transmission lines, pipelines, and roadways.

Demand Management Programs that seek to reduce demand for water through conservation, rate incentives, drought rationing, and other activities.

Diversions The action of taking water out of a river system or changing the flow of water in a system for use in another location.

Drought Conditions A time when rainfall and runoff are much less than average. One method to categorize annual rainfall is as follows, with the last two categories being drought conditions: wet, above normal, below normal, dry critical.

Dual Conveyance System A means of improving conveyance across the Bay-Delta by improving through Delta conveyance and isolating a portion of conveyance from Delta channels.

Ecosystem A recognizable, relatively homogeneous unit that includes organisms, their environment, and all the interactions among them.

Entrainment The process of drawing fish into diversions along with water, resulting in the loss of such fish.

ESA (Endangered Species Act) Federal and State legislation that provides protection for species that are in danger of extinction.

Export Water diversion from the Delta used for purposes outside the Delta.

Fish Migration Barriers Physical structures or behavioral barriers that keep fish within their migration route and prevent them from entering waters that are not desirable for them or their migration pattern.

Fish Screens Physical structures placed at water diversion facilities to keep fish from getting pulled into the facility and dying there.

Groundwater Banking Storing water in the ground for use to meet demand during dry years. In-lieu Groundwater Banking Replaces groundwater used by irrigators with surface water to build up and save underground water supply for use during drought conditions.

HMP (Hazard Mitigation Plan) One of two standards referred to in the alternatives for levee flood protection. Following the flood disasters of the 1980s, HMP standards were established at 1 foot of freeboard above the 100-year flood event level.

Hydrograph A chart or graph showing the change in flow over time for a particular stream or river.

In-Delta Storage Water storage within the Delta by converting an existing island to a reservoir.

In-lieu Groundwater Banking Replaces groundwater used by irrigators with surface water to build up and save underground water supply for use during drought conditions.

Inverted Siphon A pipeline that allows water to pass beneath an obstacle in the flow path. For example, an inverted siphon could be used to allow water in a canal to pass under a Delta channel.

Isolated Conveyance Facility A canal or pipeline that transports water between two different locations while keeping it separate from Delta water.

Land Fallowing/Retirement Allowing previously irrigated agricultural land to temporarily lie idle or purchasing such land and allowing it to remain out of production for a variety of purposes.

MAF An abbreviation for million acre feet.

Mining Drainage Remediation Controlling or treating polluted drainage from abandoned mines.

Meander Belt Protecting and preserving land in the vicinity of a river channel in order to allow the river to meander. Meander belts are a way to allow the development of natural habitat around a river.

Non-native Species Also called introduced species or exotic species; refers to plants and animals that originate elsewhere and are brought into a new area, where they may dominate the local species or in some way negatively impact the environment for native species.

Real-Time Monitoring Continuous observation in multiple locations of biological conditions on site in order to adjust water management operations to protect fish species and allow optimal operation of the water supply system.

Riparian The strip of land adjacent to a natural water course such as a river or stream. Often supports vegetation that provides the best fish habitat values when growing large enough to overhang the bank.

Riverine Habitat within or alongside a river or channel.

Setback Levee A constructed embankment to prevent flooding that is positioned some distance from the edge of the river or channel. Setback levees allow wildlife habitat to develop between the levee and the river or stream.

Shallow Water Water with little enough depth to allow for sunlight penetration, plant growth, and the development of small organisms that function as fish food. Serves as spawning areas for Delta smelt.

Smolt A young salmon that has assumed the silvery color of the adult and is ready to migrate to the sea.

Solution Principle Fundamental principles that guide the development and evaluation of Program alternatives. They provide an overall measure of acceptability of the alternatives.

South of Delta Storage Water storage supplied with water exported south from the Delta.

State Water Project (SWP) A California state water conveyance system that pumps water from the Delta for agricultural, urban domestic, and industrial purposes.

TAF An abbreviation for thousand acre feet, as in 125 TAF or 125,000 AF.

Take Limit The numbers of fish allowed to be lost or entrained at a water management facility before it must limit or cease operations. The numbers are set for different species by regulations.

Terrestrial Types of species of animal and plant wildlife that live on or grow from the land.

Through Delta Conveyance A means of improving conveyance across the Bay-Delta by a variety of modifications to Delta channels.

Upstream Storage Any water storage upstream of the Delta supplied by the Sacramento or San Joaquin Rivers or their tributaries.

Water Conservation Those practices that encourage consumers to reduce the use of water. The extent to which these practices actually create a savings in water depends on the total or basin-wide use of water.

Water Reclamation Practices that capture, treat and reuse water. The waste water is treated to meet health and safety standards depending on its intended use.

Water Transfers Voluntary water transactions conducted under state law and in keeping with federal regulations. The agency most involved is the State Water Resources Control Board (SWRCB).

Watershed An area that drains ultimately to a particular channel or river, usually bounded peripherally by a natural divide of some kind such as a hill, ridge, or mountain.

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